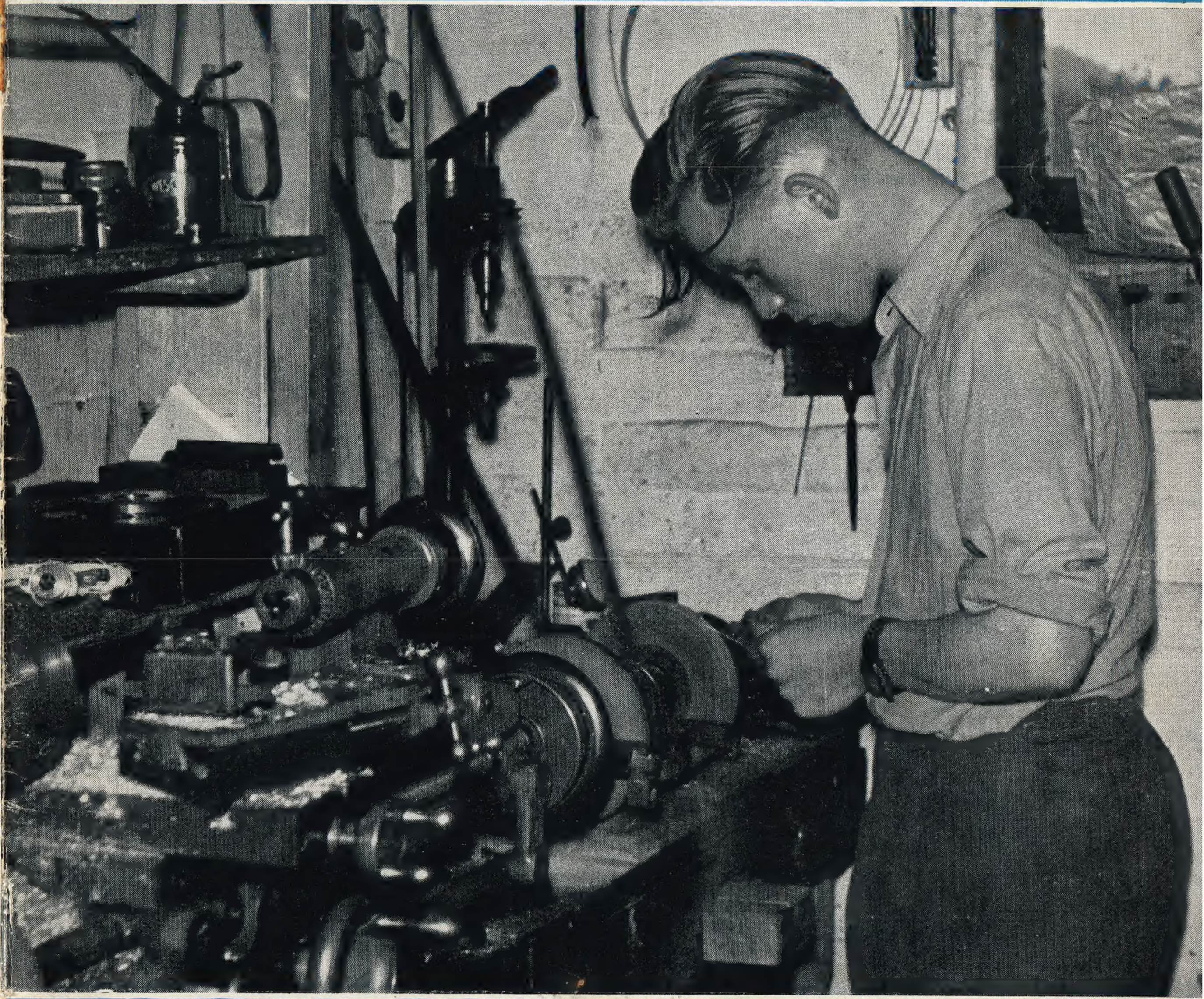
THE MODEL ENGINEER



IN THIS ISSUE

FEBRUARY 25th 1954
Vol. 110 No. 2753

9D

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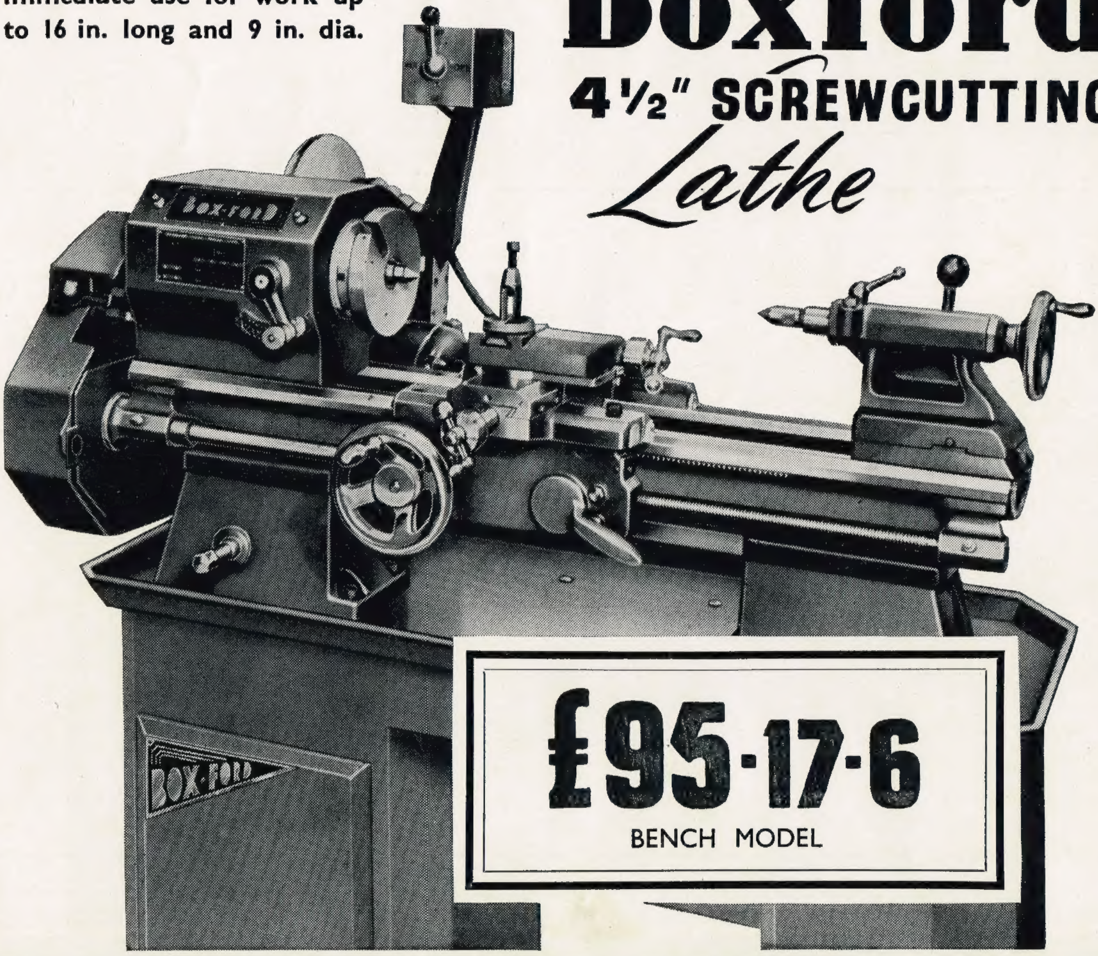

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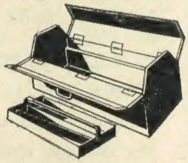

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Made to sell far in excess of our price 36/6.

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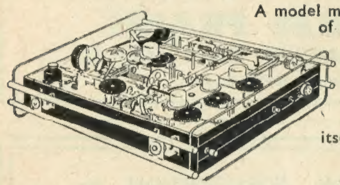

A model maker's paradise, over 65 lb. of magnificently made gears, driving shafts, bearings, miniature motor, repeater motor, gyroscopes etc. All supplied in a strong wooden transit case 24 in. x 22 in. x 11 in. high which itself is ideal as a tool box.

Only each 62/6.

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9 drills 1/16 in. to ½ in. complete with plastic case and stand. Brand new. **4/6.**

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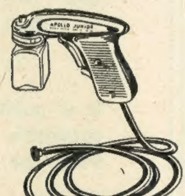

Ideal for model maker and handyman. Will spray paints, insecticides, etc. Will work from foot pump, spare car tyre, compressor etc. New and boxed. **15/-.**

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The Book for "ML7" Users
A MAN & HIS LATHE
(L. H. Sparey)
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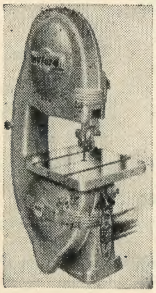
Vol. I | February 1954 | No. 2

CALLING ALL WOODWORKERS



Popular demand has already endorsed our high recommendation of the MYFORD P.R.11 $4\frac{1}{2}$ in. Bench Planer (Code No. 9403) which sets a new standard at a modest price level. Complete with Roller Extensions giving 38 in. length of table and Motor Pulley ($\frac{1}{3}$ or $\frac{1}{2}$ h.p. motor recommended) the price is only **£19 0 0** or **£5 0 0** Deposit and **28s.** Monthly.

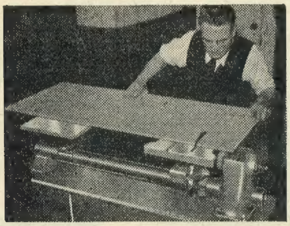
"ML8" lathe users will equally welcome the new Bandsaw Attachment (Code No. 1287) supplied ready for mounting at **£23 15 0** (**£6 5 0** Deposit and **35s.** Monthly). For those requiring the Bandsaw as an independent machine it can be offered on a special short bed assembly with motorising unit, less motor, (Code No. 9406) at **£37 15 0** (**£9 15 0** Deposit and **55s.** Monthly).

SATURDAY SPECIAL

Replying to many correspondents we would emphasise that we are OPEN ALL DAY SATURDAY.

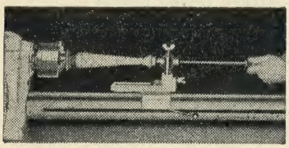
TWIN BOGIES BANISHED

Space limitations in the average workshop are sharply spotlighted when it is necessary to saw large panels. Our illustration demonstrates the value of the new Timber Support Platform (Code No. 1570M) in overcoming this difficulty for the modest outlay of **£2 17 6** complete.



Relative savings on your timber suppliers cutting charges should soon pay for this.

Another difficulty rapidly disposed of is the boring of lamp standards and similar workpieces.



The Boring Guide and Support (Code No. 1571/2M) fit the hand rest base as illustrated for use with long, handled (Code No. 1573/4M) Augers at **16s. 3d.** and **7s. 6d.** respectively. $\frac{5}{16}$ in. or $\frac{3}{8}$ in. are available.

A NEW "ML8" SANDER

As a useful adjunct to the Bandsaw and Planer Attachments we can now offer a R.H. mounting 8 in. Disc Sander (Code No. 9405). This offers an efficient tilting table unit at the economic price of **£3 17s. 6d.** (**£1 7s. 6d.** Deposit and **10s.** Monthly).

HAND TOOL RELEASES

Code No.		£	s.	d.
5820.	Set (3) for Wood ...		17	9
9471.	Set (5) ,, ,, ...	1	10	0
9789.	Set (6) ,, ,, ...	1	8	3
9470.	Set (8) ,, ,, ...	2	9	0
9942.	Set (12) Wood Carving	4	1	3
5819.	Set (6) for Metal ...	1	3	3
1557.	Set (2) Spinning ...	1	9	0
5372.	Metal Graving Tool ...		5	3

SEE HOW THEY RUN

Our last issue brought many requests for details of heavy duty Electric Motors; we recommend the BROOK "Empress" Capacitor Start, Induction Run range as follows:

Code No.	H.P.	£ s. d.
1227	$\frac{3}{4}$	15 11 8
	(or **£4 1 8** Deposit and **23s.** Monthly).	
1229	1	16 5 11
	(or **£4 5 11** Deposit and **24s.** Monthly).	
1231	$1\frac{1}{2}$	19 3 4
	(or **£5 3 4** Deposit and **28s.** Monthly).	
1233	2	22 1 4
	(or **£6 1 4** Deposit and **36s.** Monthly).	
1235	3	24 19 5
	(or **£6 19 5** Deposit and **36s.** Monthly).	

The above quotations are for single phase only, please see our 1954 Buyers' Guide for complete range.

DRILLING MACHINE
REVIEW FOR 1954

Our new season's range underlines the trend we have established to the full production machine at a competitive price rather than the doubtful compromise of light units.

FOBCO "Star"
Standard Equipment: 1/3 h.p. motor, $\frac{1}{2}$ in. chuck, tilting table and switchgear.
Code No. 1266. Bench Model **£35 8 9**
(or **£9 8 9** Deposit and **31s. 8d.** Monthly)
Code No. 1267. Floor Model **£40 6 9**
(or **£10 6 9** Deposit and **58s. 4d.** Monthly)

PROGRESS No. 1
Standard Equipment: $\frac{1}{2}$ h.p. motor, $\frac{1}{2}$ in. Chuck, tilting table and switchgear.
Code No. 8947. Bench Model **£50 12 6**
(or **£12 12 6** Deposit and **71s. 8d.** or **50s. 6d.** Monthly)

PACERA "L" Series
Standard Equipment: 1/3 h.p. motor, $\frac{1}{2}$ in. chuck, headstock guard and switchgear.
Code No. 1237. Bench Model **£40 18 6**
(or **£10 18 6** Deposit and **58s. 4d.** Monthly)
Code No. 1238. Floor Model **£43 8 6**
(or **£11 8 6** Deposit and **61s. 8d.** Monthly)

PACERA "M2" Series
Standard Equipment: $\frac{1}{2}$ h.p. motor, $\frac{1}{2}$ in. chuck, tilting table and switchgear.
Code No. 1240. Bench Model **£52 11 9**
(or **£13 11 9** Deposit and **73s. 4d.** or **51s. 8d.** Monthly)
Code No. 1241. Floor Model **£56 5 9**
(or **£14 5 9** Deposit and **78s. 4d.** or **55s.** Monthly)

PACERA "M4" Series (10 speed)
Standard Equipment: $\frac{1}{2}$ h.p. motor, 2 M.T. spindle, tilting angle table, tool tray and switchgear.
Code No. 1243. Bench Model **£67 1 9**
(or **£17 1 9** Deposit and **91s. 8s.** or **63s. 11d.** Monthly)
Code No. 1244. Floor Model **£72 13 3**
(or **£18 13 3** Deposit and **98s. 4d.** or **68s. 4d.** Monthly)

All prices are based on single phase electrics; specification and auxiliary equipment details gladly on request.

HAND OPERATED
Code No. 9780. Automatic Feed with $\frac{1}{2}$ in. chuck, heavy duty model **£5 11 0**
(or **£1 16 0** Deposit and **15s.** Monthly)

AND GRINDERS TOO!

Here are the two leaders from our popularity poll.

WOLF TG6
Code No. 8336. 6 in. bench grinder comprising 2 Aloxite wheels, $\frac{1}{4}$ h.p. motor (220/250 A.C.), switch, tool rests and guards. **£17 17 0** (or **£4 12 0** Deposit and **26s. 6d.** Monthly).

BLACK & DECKER/VAN DORN
Code No. 6578. 6 in. bench grinder comprising 1 Aloxite wheel, 1 wire scratch brush, $\frac{1}{4}$ h.p. motor (220/25 A.C.), switch tool rests and guards. **£15 17 6** (or **£3 17 6** Deposit and **24s.** Monthly).

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THE MODEL ENGINEER

EVERY THURSDAY

Volume 110 - No. 2753

FEBRUARY 25th - 1954

ESTABLISHED 1898

PERCIVAL MARSHALL & CO. LTD. 19-20 NOEL STREET · LONDON · W·1·

CONTENTS

Our Cover Picture

This photograph, which depicts the interior of a typical model engineer's workshop, has been submitted to us by Mr. Godfrey Pratt, of London, W.12, and a point of added interest about it is that it was taken with a home-made camera and flashgun, which was entered in the 1952 "M.E." Exhibition, and was described in detail in the issues of "The Model Engineer" dated April 16th and 23rd, 1953. The friend seen in the photograph is polishing, on a buffing wheel, a component for a large press camera which has been evolved, in the course of some eighteen months, from components of an ancient stereoscopic camera rescued from the dustbin. Mr. Pratt observes that there is much to be gained by inviting a friend, who may be handicapped by lack of equipment and facilities, into the workshop to take part in a joint undertaking. Not only are discussions and exchange of views helpful, but each one is almost certain to learn new methods, or new angles of approach to workshop problems.

SMOKE RINGS

Would It ?

AT A model engineering club meeting recently, a reader told us the following anecdote: He had been abroad on business for some weeks and, as it happened, had been able to buy a copy of THE MODEL ENGINEER each week in the town where he stayed. His return home took some days, during which he missed being able to buy that week's issue. At the London railway station at which his boat train arrived, he went to the bookstall and asked for a copy of the previous Thursday's issue; the assistant looked through his stock and then said, "Sorry, sir, we haven't one left. But here is a copy for the week before, if that will do." Evidently, a budding salesman !

The Last Webb "Coal" Engine

IN 1873, Mr. F. W. Webb built the first example of his first locomotive design for the old London and North Western Railway; it was an 0-6-0 tender engine with 4 ft. 3 in. wheels, and during the ensuing 19 years, up to 1892, no fewer than 500 similar engines were constructed at Crewe. Originally, these engines had cylinders 17 in. diameter by 24 in. stroke; a boiler pressure of 140 lb.; a heating surface of 1,075 sq. ft., and a grate area of 17.1 sq. ft. Later, the boiler pressure was raised to 150 lb., and the diameter of the wheels, by the use of thicker tyres, was standardised at 4 ft. 5½ in. The weight in working order was 57 tons, and the tractive effort was estimated at 16,530 lb. The engines had Stephenson link motion, and a very distinctive feature was the use of cast-iron wheels with I-section spokes. Because these engines were used almost exclusively for working very heavy coal traffic, they were always known as the "Coal" engines.

They were possibly the simplest and cheapest main-line locomotives ever built in Britain, and, at one time, Mr. Webb claimed that they could be built for £400 apiece; to substantiate this claim, one of them, No. 25, was constructed in no more than 50 working hours. That there was nothing amiss with this very rapid construction, even though there is no suggestion that every engine was built in 50 hours, is clear from the fact that the last engine to be withdrawn from traffic, and thereby making the class extinct, was in active service for 72 years. She was B.R. No. 58343, originally L.N.W.R. No. 2405, built in 1881; she was broken up last December.

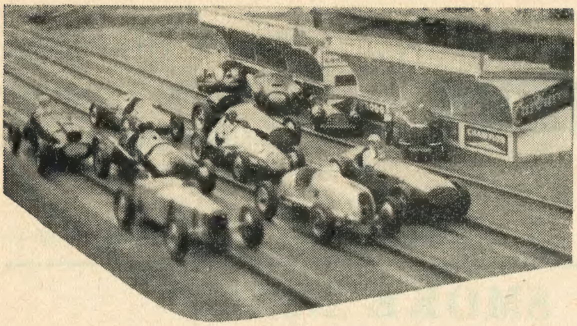
A Handicraft's Competition

REGULATIONS HAVE recently been issued for the Prize Drawing and Handicraft Competitions (1954) of the Institute of British Carriage & Automobile Manufacturers. Five of the competitions relate to drawings of motor vehicles with bodywork, and the sixth is the handicraft competition, concerned with two subjects, as follow:—

Bodymaking: model of a front bulkhead frame assembly for a single-deck bus body, to a drawing supplied. It is to be constructed in suitable seasoned hardwood, and no metal reinforcements are to be used. (It is interesting to note that models are to be given a thin protective coat of clear varnish or shellac, but no stopping or filling is to be used.)

Sheet Metal Work: An all-metal door, comprising inner and outer panels, with reinforcements, in 20-gauge sheet steel for a small open sports car, to drawing supplied.

The handicraft competition and one of the drawing competitions (that for a racing car) are open only to persons of British nationality who are students of technical schools and employees in British workshops, and under the age of 21 or 23, as the case may be, at the closing date for the receipt of entries. Further particulars are available from the Institute, at 50, Pall Mall, London, S.W.1, and closing date is Saturday, May 22nd.



A group of N.L.M.E.S. cars at the pits during a demonstration at Park Royal. (Photo. A. E. Dowell)

MODEL CAR NOTES AND NEWS

Circuit-Racing

By Geoffrey Deason

IF my notes on racing "Two-fives" gave the impression that all model cars are ferocious tubes of dynamite with a wheel at each corner, it is high time that we took a look at the other side of the medal, and with this in mind I paid a visit recently to a monthly meeting of the North London S.M.E.'s car section, held at the St. John's Hall, Friern Barnet Lane, N.20. This is the London home of circuit or "rail" racing, and whilst there are no specific rules governing this point, it should be explained that there exists a "gentleman's agreement" amongst circuit-racing enthusiasts all over the country that all competing cars should be of scale type.

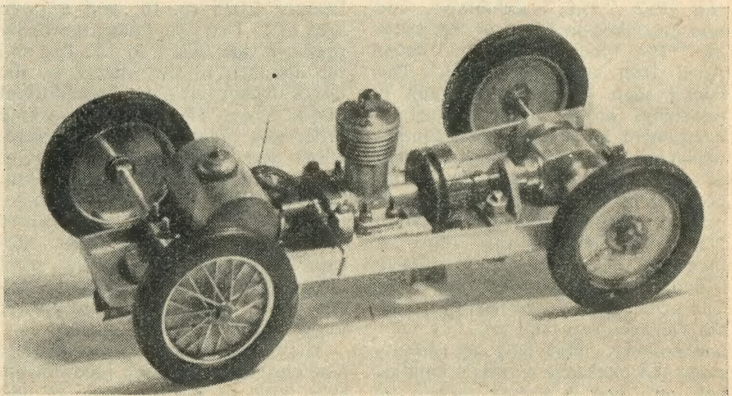
Where power-driven model racing cars are concerned, the term "scale-type" is comparative, and has a somewhat different meaning to the term as applied, say, to model locomotives. These miniatures, whose scale speeds are relatively so much higher than their prototypes, have to stand rough handling and a considerable battering in action, and have perforce to be simplified in detail and stiffened up in their basic structure. Hence it is legitimate to refer to a car as being of scale type, provided that it follows a known prototype in outline and general proportions, or, if of free-lance type, that it should resemble the conventional conception of a full-sized racing or sports car without those flagrant anachronisms which are so much easier to recognise than to describe ! This flexible but eminently workable agreement has so far been admirably adhered to by the various clubs which operate racing circuits, and the North London Society's models are no exception.

Naturally, the standard of workmanship varies, but members are unanimous in fostering realism in their miniature motoring, a term which fits their activities admirably. Their track, built of the usual hardboard in 21 sections, accommodates four $\frac{5}{16}$-in. tubular steel guide-rails, and is carried on light supports of aluminium angle-work, which elevate the "road" from 6 in. above floor level to a maximum of 2 ft. 6 in. by easy grades. The lap measures 75 ft. 3 in. on the centre-line, and the track in plan is similar to that of the old Brooklands Outer Circuit, having a pronounced in-sweep round the imaginary Vickers Sheds, this portion being taken up-hill.

Amongst the models present on the occasion of my visit, two outstandingly reliable performers were those of Mr. W. Hammersley. These were of simple construction, with balsa bodywork inspired by B.R.M. and Cooper Bristol. The former car was fitted with home-constructed driving wheels of the "rubber heel" variety, the front wheels being modified "Juneero" products. Both use roller guides and steered front axles, and were equipped with most life-like dummy drivers.

The society's hon. secretary, Mr. W. W. Ransom, was running his neat Rhiando Trimax, modelled on the pretty but not over-successful half-litre car evolved by the colourful Spike Rhiando several seasons back. The chassis is of straightforward design, powered by a Weaver-designed engine driving through a centrifugal clutch, and the bodywork is neatly and accurately modelled in obechi. A well-detailed cockpit, with the authentic pigskin upholstery and unusual horizontal gear and brake handles, adds to its attraction. Mr. Ransom also had with him the chassis of his latest project, an Aston Martin DB2 saloon. This well-finished chassis has deep tapering side-members of dural, with the E.D. Bee engine placed well back and driving the front wheels via a centrifugal clutch and long propeller-shaft, an arrangement which will bring the power-unit well into the saloon bodywork. The fuel tank is cylindrical, and is carried vertically in the tail.

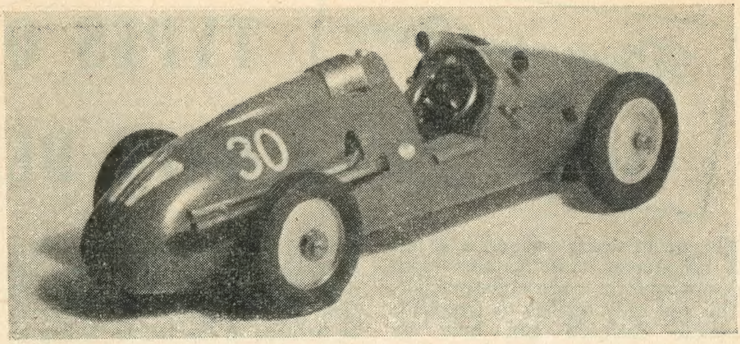
Two notable models, both as yet unfinished, were the old Grand Prix $1\frac{1}{2}$ litre Delage and a J. Type M.G. by Arthur Weaver, whose craft in metal-working is always a delight to inspect. The little Delage has a



Chris Thorp's E.D. powered M.G. chassis. Note fixed guide shoe and "crank-case" axle casing

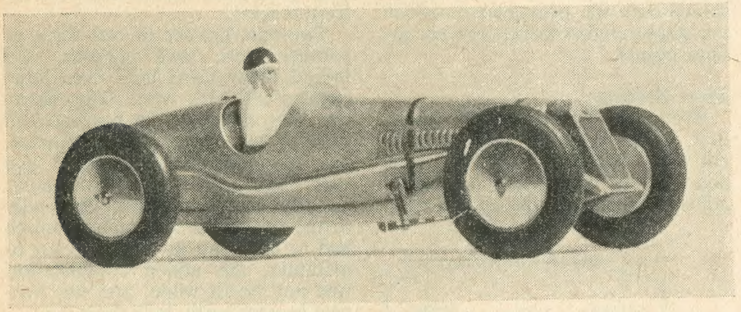
beautifully constructed radiator soldered up from thin copper sheet, accurately detailed drop-arm and drag-link, and the long tapering exhaust-pipe, famous for frying the feet of the unhappy drivers of the full-sized cars until moved to the other side of the engines! This model uses a channel-section frame arranged as an inverted U, in contrast to the M.G., which I believe is the first model from the Weaver stable to have the channel in the conventional position, open side inwards. Like several other club models, the M.G. has a workmanlike axle-gear box casing constructed from a crankcase casting from the standard "club" engine. The engine in this car, however, has crankcase induction controlled by a rotary disc-valve.

Two points of interest struck me whilst watching the cars perform. First, the diversity of fuel-tanks, which appear in all shapes and positions without apparently affecting the running of the cars in any way; feed troubles caused by centrifugal force, so prevalent in cable-racing, seem to be entirely absent in circuit running, despite sudden and violent changes of direction. Secondly, a number of N.L.M.E.S.'s cars have now dispensed with the swivelling guide-roller and steering axle arrangement in favour of fixed shoes, not unlike those used on Mr. Rex Hays's demonstration models, but shorter in length.. Several others employ pairs of fixed rollers of standard pattern. Models so fitted were watched with a critical eye, but it was next to impossible to detect any difference in the cars' behaviour in comparison with the steered models, and I am assured by the club's officials that no ill-effects are suffered either by the tyres or the track, probably by reason of the rather oily surface which forms after a period of use. This method certainly makes for simplicity of construction, and may influence more model car enthusiasts to convert to circuit-racing, who up to the present may have fought shy of the construction of the more complicated roller system, which demands a considerable degree of accuracy in machining.



An unusual prototype, W. W. Ransom's Rhiando Trimax 500, with hardwood bodywork

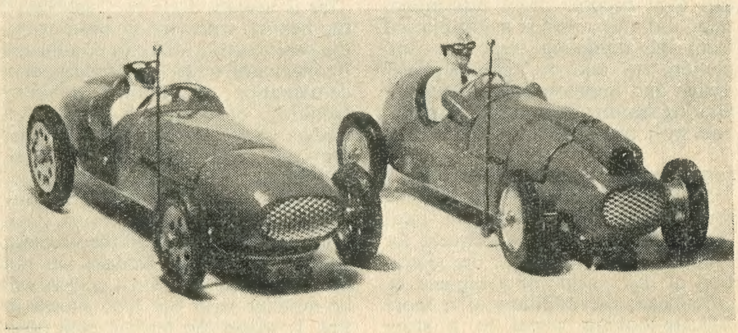
Whilst discussing form over the inevitable "cuppa" afterwards, Mr. Thorp pointed out that the society is not only anxious to recruit new racing members, but built its track to "standard" pattern rather than to its own design with the specific purpose of inter-club competitions in mind. The club's rules are simple and few. Visiting cars must not exceed 1 c.c. or 2 lb. overall weight, with track not exceeding $5\frac{1}{2}$ in., and some external stopping device must be fitted.



A fine example of metalwork, Arthur Weaver's 1 c.c. G.P. Delage model

Interested clubs or lone hands are invited to contact Mr. Thorp, 94, Braemar Avenue, Neasden, N.W.10.

The Model Car Association recently announced a circuit-racing meeting, to be staged on the Meteor M.R.C.C.'s track at Rists' Cables canteen, Newcastle under Lyme, on February 27th/28th next. This event will take the form of a full-blown miniature Grand Prix for the M.G. Trophy, which is now to be devoted to this branch of the hobby. I understand that the affair will be open to all-comers, whether affiliated to the M.C.A. or not. Perhaps it is unwise to prophesy whilst matters are still under discussion, but it would certainly seem as though some form of class handicap will have to be operated, the two categories most likely being 1 c.c. and 1.5 c.c., as the latter is the existing top limit, and the 0.5 c.c. class has not as yet materialised. I hope, speaking personally, that some latitude will also be permitted in the matter of attachments, provided that safety considerations are satisfied.



Cooper-Bristol and B.R.M.-inspired circuit-racer, built by Mr. W. Hammersley

Talking about Steam
No. 25
By W. J. Hughes

TYPES OF MAIN BEARINGS

IN model steam engines, it is not uncommon to see features which do not conform to prototype practice. This not only applies to free-lance engines designed and built by amateurs, but, too often, to designs marketed by commercial firms and called by "prototype" names. I have in mind particularly a so-called "mill-engine" which has various

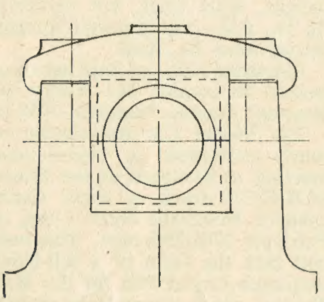


Fig. 1. *Two-part bearing, square type.*

undesirable features: its sole merit to me—if it is a merit—is that it is quick and easy to build, and would give a beginner practice in machining and assembly.

The model engineer can please himself, and quite rightly does so, as to what he builds in his workshop; that is half the fun. And again quite rightly, he often starts off with some quite simple "commercial" model, on the principle of learning to walk before he can run. With an increase in knowledge, confidence, and craftsmanship, he can then become more discriminating, and either tackle a job himself from the designing stage to completion, or, take a "commercial" design and improve it by adding or altering features to bring it more into line with prototype practice.

Improvements Sometimes Aren't !

Such improvements can include, for example, the fitting of extra studs and nuts to secure covers for cylinder and valve-chest, the alteration of the outline of a big-end or cross-head, the addition of a more delicate-looking wheel to a stop-valve, the fitting of handrails, and so on. It has to be admitted, though, that these additions and/or alterations do not always have the desired effect. This may be due to lack of knowledge or experience, or perhaps to the builder failing to appreciate the need for correct scale appearance. Whatever the reason, the result sometimes can be distinctly unhappy.

In the next few articles of this series, it is proposed to discuss the design of various bits and pieces of prototype stationary engines—bearings, big-ends, cross-heads, and so forth—and to give concrete examples of them. This should be of use not only to the designer of a free-lance engine, but to the tyro who understands only the principles on which the steam engine works, but not the finer points.

Main Bearings

Even the beginner will realise that when bearings wear, in the natural course of events, it is necessary to have some method of adjusting them to take up the wear.

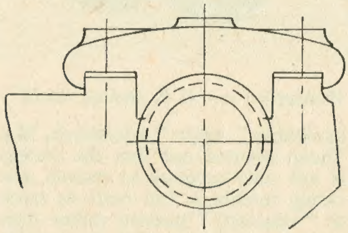


Fig. 2. *Two-part bearing, with round brasses*

This is usually done by "splitting" the bearing into two or more parts, the position of which can be adjusted by means of screws or wedges, or a combination of both. (Strictly speaking, of course, a screw *is* a wedge, of special shape.) A further purpose of splitting the bearings, of course, is to allow of easier insertion of the shafts. In many engines of small horse-powers, however, the bearings are of the simplest, and screws and/or wedges are not deemed necessary. Most readers will be familiar with the type shown in Fig. 1, where the bush is split horizontally. It is square in section, and a shallow groove is machined all round the edges, to hold it in place laterally. A bearing-cap with central oil-syphon holds the brasses in their recess, and is itself secured by two studs fitted with nuts and lock-nuts.

Fig. 2 shows a variation of this idea, with the bush, still split horizontally, now cylindrical in section. In Fig. 3, the same idea is seen, but with the whole bearing at an angle of 45 deg., more in line with the prevailing wear, so to speak. This rendered easier the taking-up of the bearing when worn. Another variation of the "square" type is seen in Fig. 4. The brass is now split vertically—though not axially in line—and screw adjustment from the front is used.

Two-part brasses of one form or another were very popular, and indeed many firms built even large engines with this type. The reason was that although the bearing with three or more parts, wedge-adjusted, had many advantages, it could give very bad results if not properly adjusted and maintained. Especially in the case of small engines, which had to be cheap to buy and easy to maintain, the added complication was not worth while, and the two-part brasses easily held their own.

Three-part Brasses

Fig. 5 shows a bearing-bush split into three parts, with screw adjustment to the front brass, and Fig. 6 depicts another three-part bearing, this time with adjustment by twin wedges, which themselves can be adjusted by means of the set-screws. Usually a draw-bolt was also fitted to each wedge, in the manner shortly

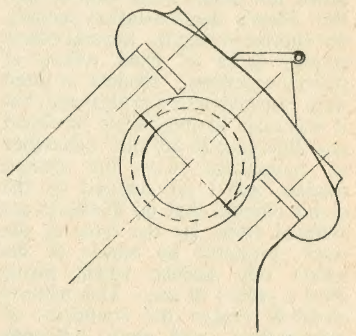


Fig. 3. *Inclined two-part bearing*

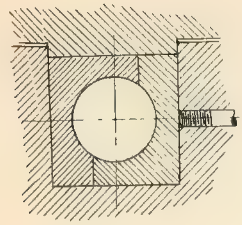


Fig. 4. Two-part bearing, split vertically

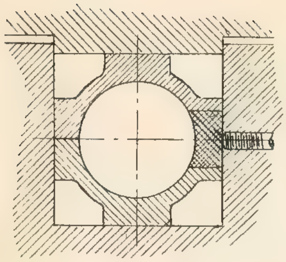


Fig. 5. Three-part bearing, screw-adjusted

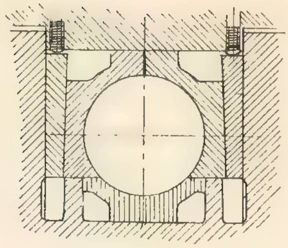
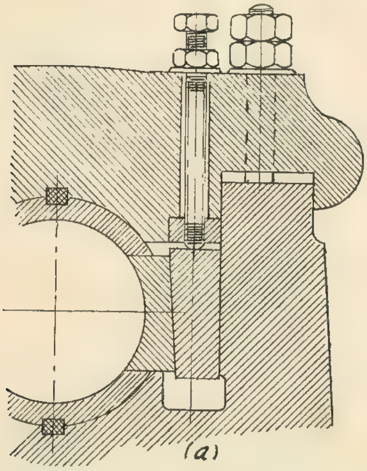


Fig. 6. Three-part bearing, wedge adjusted

to be described in connection with the four-part brasses.

Machining the brasses, by the way, was done in the same manner for all multi-part brasses. The flat joint-faces of the parts having been



planed up, they were soldered together, and could then be treated as one piece, to be bored out, turned, and otherwise machined as required. After "fitting" to the pedestal or bracket, they could be removed and easily separated by heating. Sometimes, after planing the jointing surfaces, the parts were clamped and pinned together for machining, instead of soldering, but the principle was the same, of course.

Bearing Metals

For the tyro, it should be explained, perhaps, that when we talk about "brasses" in connection with bearings, the alloy is quite different from that which is commonly called brass. Gunmetal or bronze were popularly used, but even these two names have many meanings, since different manufacturers had their own ideas as to what proportions of each component metal should be used in the alloy. The chief considerations were, and are, that the alloy should be able to stand up to a pressure well in excess of any it

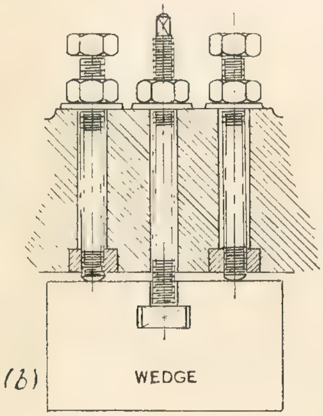


Fig. 7. Four-part bearing with wedge adjustment

would be likely to have to bear; secondly it should be comparatively soft, so that if it overheated by some mischance and "seized" the shaft, the latter should not be damaged. It should also be a good conductor of heat, and of a consistency easy to machine.

Four-part Brasses

In the two-part and three-part brasses previously discussed, we have only shown two or three of the very many different varieties, and the same will have to apply to the four-part ones, for reasons of space. In any event, all I want to do is to give the reader, and especially the tyro, an idea of the principles involved. Fig. 7(*a*) is a section through a four-part bush, in which it will be seen that the parts at the sides can be adjusted by means of wedges. The wedges themselves are adjusted as shown in Fig. 7(*b*), where the set-screws exert downward pressure, but the square-headed central draw-bolt may be used to raise the wedge, when necessary.

In this connection, it was often considered preferable to design the bearing so that the taper of the wedge was in the opposite direction to that shown. In such a case, of course, *raising* the wedge tightened the bearing, but the advantage was that if the lock-nut(s) of the bolt(s) became slack, due to vibration or other cause, the wedge dropped and slackened the bearing. The resultant "knock" would immediately inform the engine-man that something was wrong. But if the wedge tapered the other way, and the nuts became

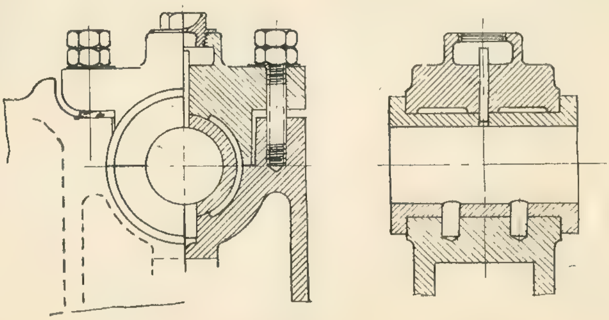


Fig. 9. Actual example of two-part bearing

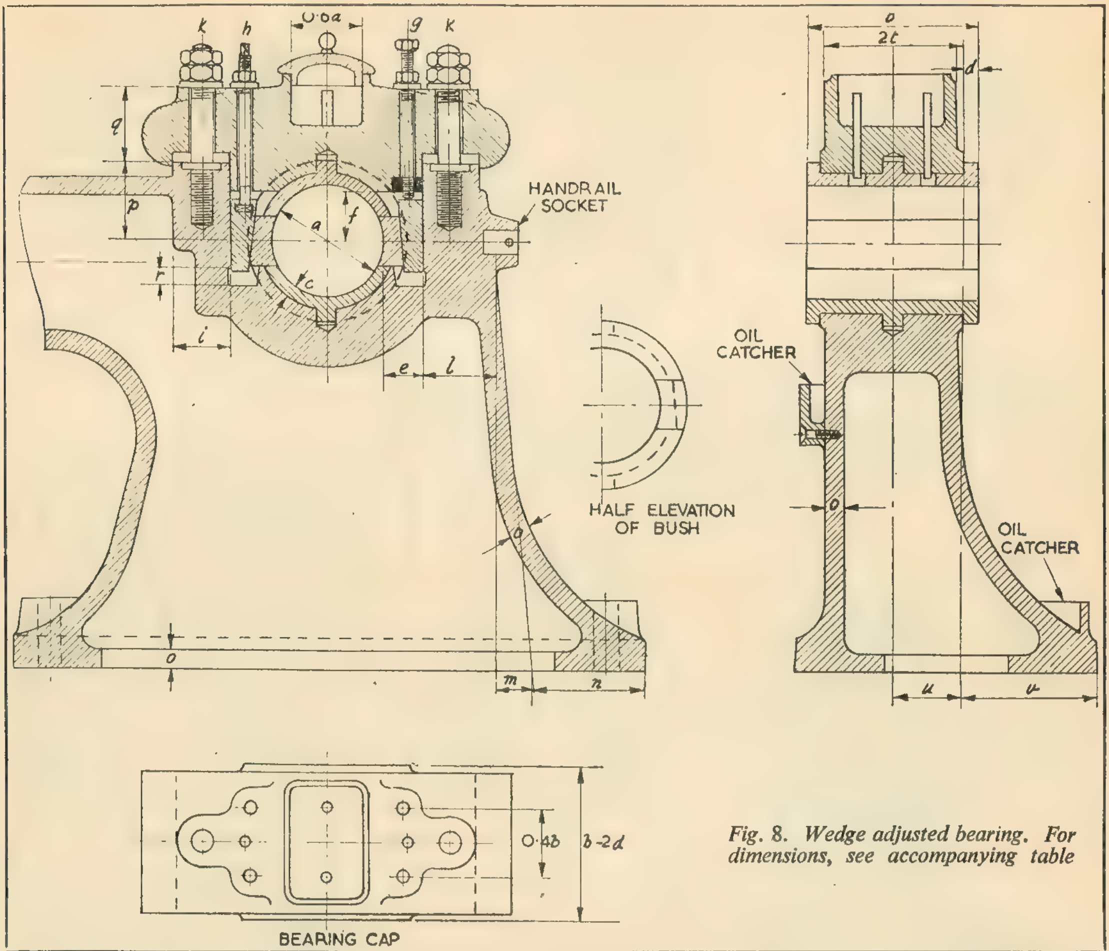


Fig. 8. Wedge adjusted bearing. For dimensions, see accompanying table

slack, the weight of the wedge would tighten the bearing, which might well overheat before being noticed.

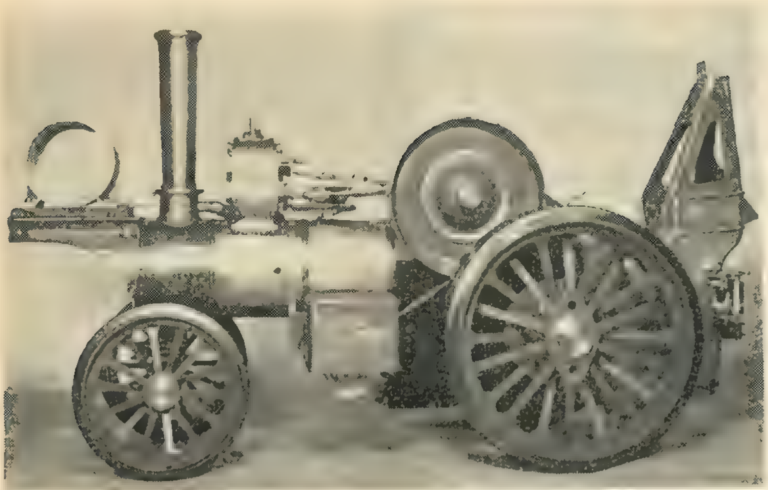
Regarding points of design, another desirable feature, especially with larger engines, was to ensure that the parts of the bearing could be removed with a minimum of trouble. It will be obvious, for example, that in Fig. 5 the lower brass cannot be removed without raising the shaft right out of the socket, a considerable task with a really heavy shaft and flywheel. But in several of the other types—e.g., Fig. 2—if the shaft be jacked up even a fraction of an inch, the worn lower brass can be rotated round the shaft and taken out through the top. Thus the matter of re-fitting a worn brass is rendered much easier.

Returning to the four-part type of bearing, Fig. 8 illustrates one similar to that in Fig. 7, as used in the girder-type of stationary engine. Adjustment is by wedges, with two set-screws and a single drawbolt, the square nuts for the former being set in recesses on the underside of the bearing-cap. Lubrication is by two syphons set in the cap, which is held down by two bolts in the smaller sizes, and four in the larger. Dowels are formed in the upper and lower brasses, to resist any rotative tendency.

It will be recalled that earlier in this series I gave a table of dimensions of girder frames, and I feel sure that the following table of dimensions will be of equal interest. Later on it is hoped to give similar

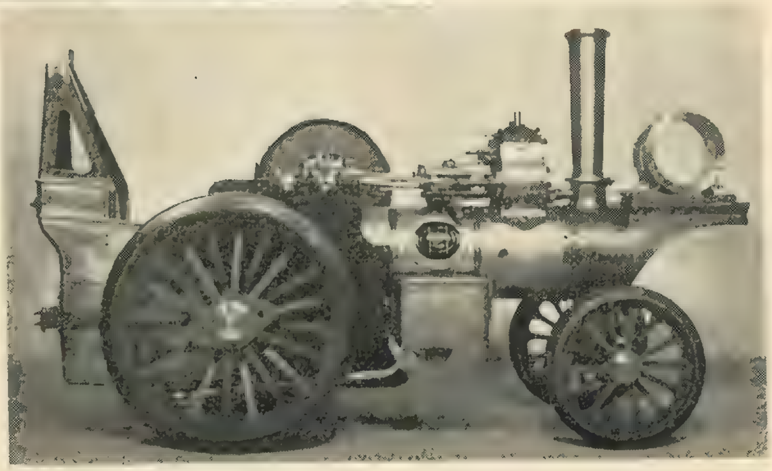
Bore	Stroke	a	b	c	d	e	f	g	h	i	No. of Bolts	k	l	m	n	o	p	q	r	t	u	v
8	16	3 5/8	5 7/8	7/16	1/2	1 1/4	1 3/8	5/8	1/2	2 1/4	2	7/8	2 5/8	—	4 1/4	3/4	2 1/2	2 1/4	7/8	2	2 1/2	—
10	20	4 1/2	7 1/4	7/16	1/2	1 3/8	1 5/8	5/8	1/2	2 1/2	2	1	3	1 5/8	5	3/4	3 1/4	2 5/8	1	2 3/4	3 1/4	5 3/4
12	24	5 1/4	8 1/2	1/2	5/8	1 1/2	2	5/8	1/2	2 3/4	2	1 1/8	3 5/8	1 7/8	6 1/8	7/8	4	3	1 1/4	3 1/8	3 3/4	7 1/4
14	28	6 3/8	9 1/2	9/16	5/8	1 3/4	2 3/8	3/4	1/2	3 1/4	2	1 1/4	4 1/4	2 3/16	6 5/8	1	4 3/4	3 3/8	1 3/8	3 5/8	4 1/4	7 3/4
16	32	7	10 3/4	5/8	3/4	1 3/4	2 3/4	3/4	1/2	3 5/8	2	1 1/4	4 3/4	2 3/8	7 5/8	1	5 5/8	3 3/4	1 1/2	4 1/8	4 3/4	8 1/4
18	36	7 5/8	12	5/8	3/4	2 1/8	3 1/4	7/8	5/8	4	4	1 1/4	5 3/8	2 7/16	7 3/4	1 1/8	6 1/2	4 1/4	1 3/4	4 3/4	5 1/8	9 1/2
20	40	8 3/4	13 1/4	3/4	7/8	2 3/8	3 5/8	7/8	5/8	4 5/8	4	1 3/8	6	2 7/8	8 3/8	1 1/4	7 1/4	4 5/8	2	5 1/4	6	10
22	44	10	14 3/4	13/16	1	2 1/2	4	7/8	5/8	5 1/4	4	1 3/8	6 3/4	3	8 3/4	1 1/4	7 3/4	5	2 1/4	5 3/4	6 1/2	11 1/2

All dimensions in inches. Reproduced from "Handbook on The Steam Engine" by Haeder & Powles (Crosby Lockwood, 1893), with acknowledgments to The Technical Press Ltd.



Photograph No. 1. (left): A Fowler "Super Lion" showman's road locomotive which is being built to 1½-in. scale by S. T. Harris of Cricklewood

Photograph No. 2 (below): Mr. Harris's Fowler will be fully detailed. Note, for example, the beaded bands on the boiler cleading



tables for other parts, including the cylinder and valve-chest, so that the would-be modeller will have a good guide as to the correct proportions.

An Actual Example

As an actual example of a two-part bearing, let us consider Fig. 9, which is from a small engine—9 in. bore by 18 in. stroke—of n.h.p., fitted with Rider expansion gear. The bed-plate was of the "bayonet" semi-girder type; the speed was 100 r.p.m. In this case, the split bearing-bush is 3½ in. internal diameter and 10½ in. long; it is held down by a flat cap, 1½ in. thick, secured by four ½-in. studs and double nuts. Oil is fed by syphon from a somewhat small oil-box with screwed cap, and the lower brass is prevented from rotation by two separate dowels.

This engine was fitted with a disc-type overhung crank, close to the bearing, with eccentrics and flywheel at the other side. The other end of the shaft was supported by a separate bearing of similar design, on a masonry stool.

A Magnificent Fowler

Now, for a change, let us look at some photographs of a magnificent "Super Lion" which is being built by S. T. Harris of Cricklewood. The model is of one of the latest class of Fowler road locomotives, similar to *Supreme* and *Onward*, and is based on the maker's official drawings. It is to 1½-in. scale, and, as the photographs show, the detail work is being beautifully carried out—in fact, the whole job is !

At the time of writing, I haven't many particulars of the model, but hope to have some more for inclusion next time, with the other photographs that Mr. Harris has kindly sent. She certainly is a lovely job !

TWIN SISTERS

by J. I. AUSTEN-WALTON

APOLOGIES, first of all, to all my readers for yet another long delay in the present series. A number have written, I believe, to THE MODEL ENGINEER offices, asking where I had got to. Well, here I am again, presenting the usual construction stuff that quite often proves to be both controversial and provocative.

Early in the autumn, I was claimed to do some special research work in connection with a type of projectile that guides itself about, and other activities not unconnected with infinitely small, but tremendously powerful, particles of matter. To say that this was a refreshing change from the more peaceful and contented atmosphere of locomotives, would be a gross exaggeration, and I cannot claim to have enjoyed myself in the unexpected diversion. Nevertheless, the rent and rates are as punctual and exacting as ever, and quite inescapable, and so one must bow to the inevitable and spend much valuable time in providing the essentials of life.

The demands made on my time since this series started, have increased fourfold, if not more; and I do not confine this to purely commercial activities. I seem to know vast numbers of the small locomotive fraternity, who write to me and I to them. They send photographs and all manner of material of locomotive interest, and so my bookshelves grow longer and my photograph albums grow fatter. My greatest joy is in getting round about, meeting the people who write to me; seeing their locomotives perform, and making mental notes of everything that looks like progress. But let us return to the job in hand.

Platforms

Often misquoted and argued about and often called footplates, running-boards and side plates; but the drawing shows the parts we are talking about. These are made in two parts, the shorter being at the front end and made to detach easily for access to the removable steamchest covers—one of the most popular features in the locomotive, so I am informed. The after portion may remain fixed permanently, and the side tanks are bolted down securely by means of two fixed studs made into the base of the tanks, and passing through the two $\frac{3}{16}$-in. holes shown. There is a very generous opening provided at the back end where the cab and bunker sit; but the true cab floor entirely covers this and finishes off the job in a neat and true-to-prototype style. The big opening is also very useful when it comes to the setting out of the many pipes that run from the backhead, and anything that helps in this rather fiddling set of operations, should be welcome.

The joint in the two plate sections is made to be neat and even invisible, if sufficient care is taken when making the parts. The valance angle runs a little past the main plate, and the removable section picks up with a single tapped hole in it. Three other 8-B.A. studs complete the fixing here, and at a conservative estimate, one minute should suffice for the removal of either section, and the perfectly free access to the steamchest and other parts thereabouts. There are other slots or openings to be made; there is a long one in the main section, running inwards and provided to encircle the bearing for the weigh-shaft. It would be as well to check up on the actual width and position of the parts as you have made them, rather than follow the drawing blindly; the dimensions given are those of my locomotive, and, if you like, the theoretically correct positions and sizes. Another small opening in the front section is for the lifting-links; it is cut wide enough to pass the entire fork-end of the link and it helps to make the plate removal free and easy. You may find, due to very small differences in construction or geometry, that the opening has to be extended back into the main plate, but it does not matter if this is so, for the plates when assembled will complete and enclose the opening quite neatly.

The last opening is for the benefit of those who have gone to the trouble of fitting the twin oil-boxes as described a little while ago, (on the drawing this opening is shown for oil holes, it should be oil-boxes). Let us hope nobody has pinned his hopes on fitting this item on the platform itself, for the reason that should now be perfectly clear. There is also a narrow strip cut away from the inside front edge, to clear the frames and projecting dummy rivet heads on the raised section of the frames, just where the smokebox fits. I had a little trouble here myself, and found that the provision of a little extra height in the row of rivets, would have been a great advantage.

Next, the large holes. The elongated hole is for the injector water-feed elbow to come right through, and if it is your intention to fit only one injector, this hole may be omitted on the right-hand plate. The plain $\frac{1}{2}$-in. hole is for the side tank drain-valve to be fitted immediately above it. After working at a fete or other meeting, it is convenient to be able to drain off all the remaining water before transporting the engine away. Turning a 5-in. gauge engine upside down, and shaking it, is a pastime reserved for young giants and those who enjoy disgustingly good health and energy; apart from which, it's an undignified way of ending a pleasant day's running.

The assembled platforms should project by $\frac{1}{4}$ in. over the rear buffer beam; the dimension given is *not* a mistake. There should be a slight overlap at the front, to mate up with the existing overlap provided for the front sweep from the smokebox (if you have got to that stage). The material for the platforms should be no less than 16-gauge, steel or brass. At one time, I used nothing but brass, but due to heavy wear and tear and constant wiping down, I found it difficult to keep the paint from rubbing off the valance angle rivet heads. Recently, I have used steel, treating it beforehand with one of the better-known rust preventatives such as Jenolite, Phescote or the like. These liquids form an excellent key for the paint, and appear to stop the formation of rust indefinitely, which is the one thing we wish to guard against.

Since this series was started, I have learned another most useful tip from Mr. K. N. Harris. This was the application of the liquid iron perchloride to the brass, forming a sort of etched and frosted

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Continued from page 528, *October* 28, 1953, *Vol.* 109.

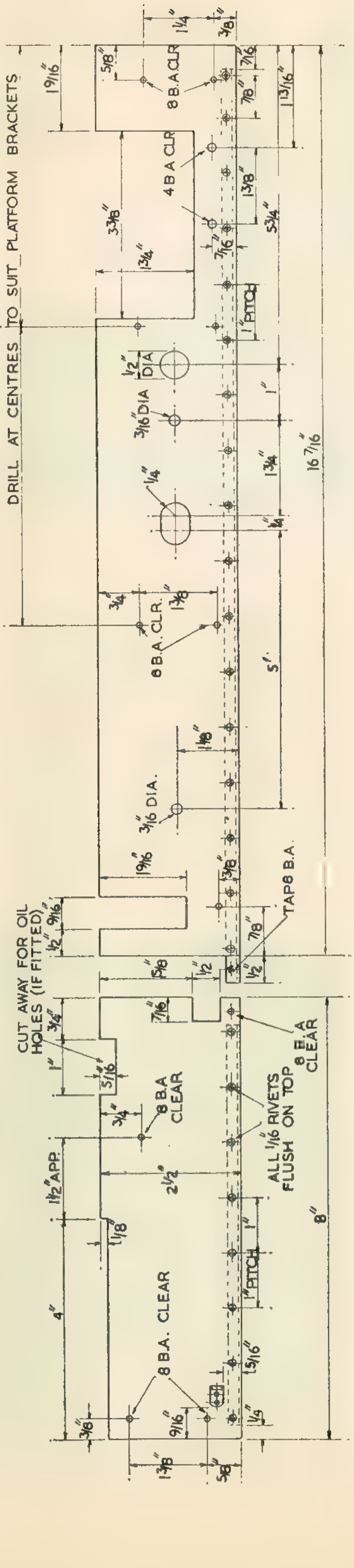
finish to which paint would readily adhere. There is no doubt about this dark and thickish liquid doing the job, and when the parts are subsequently washed off well with clean water, and you take care not to daub your greasy hands all over the metal, you have a job to get the paint off even if you *try*. Rubbing the brass down with extra-coarse emery cloth, is a poor expedient after this quick and efficient method, and it gets all round the rivet heads where you cannot reach with abrasives.

The valance angle is shown as $\frac{1}{2}$ in. × $\frac{1}{4}$ in. × $\frac{1}{16}$ in. brass, which is a popular standard section. This is fixed along its edge by $\frac{1}{16}$ in. brass or copper rivets at 1 in. pitch or thereabouts. All the rivets are finished flush on the top face, but it would be no sin if there were slight traces of rivet countersinks after the job was done. If you want to know what I mean, take a walk along any full-size locomotive platform, and you'll probably trip over the heads of the flush rivets. But let me give you a word of warning where flush riveting is being carried out. Most builders do far too much hammering when fetching up the rivets, probably in a misled effort to fill up the countersink they have made to receive it. This results in a very severe spreading of the metal locally, and a great deal of distortion into the bargain. You must remember that you are dealing with relatively thin plates and sections, the composition of which may be little if any harder than the metal of the rivet you are beating down. The rivet has to swell in the hole to be of any use, and that tendency to swell must result in a spreading action in the parts being joined together.

Flat and Straight

This leads me to flatness and straightness generally. When fitting the platforms, start off by placing a straight-edge across the two buffer beams, noting any discrepancies in the height of the platform brackets. If they are not all level, the finished locomotive will look dreadful, and will silently reproach you for evermore. Brackets that are only slightly *high*, may be taken off and filed down, whilst those falling short of the mark should be fitted with packing strips, secured by tiny rivets in places where the fixing studs will not come.

Having secured your correct levels in this department, turn to the preparation of the sheet metal parts themselves. I have already given advice on this, but no harm will be



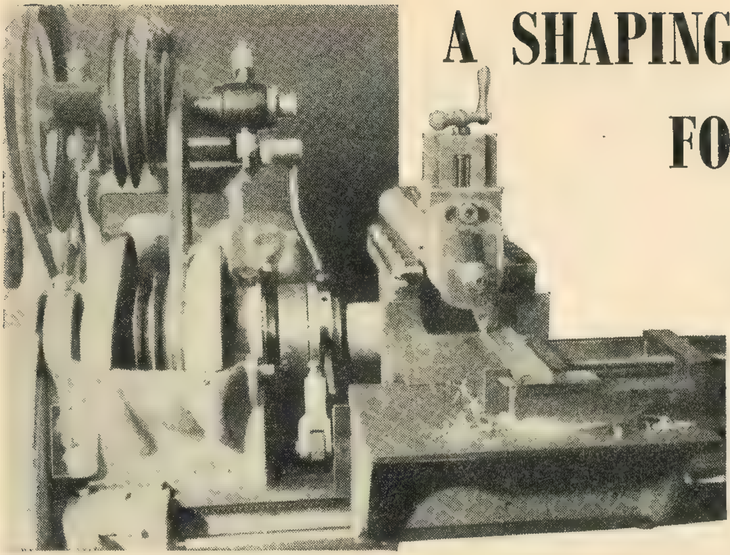
done by going over the salient points once more. Bright mild-steel looks very nice and flat, and has a good surface, but there are snags. The bright finish is obtained by cold working after the section has been produced in the hot rolls. Cold working straightens and polishes the metal, and hardens it to some degree, due to the sheer brute force of cold compression. All is well until you start to cut bits out of it, unnoticeable in very small pieces, perhaps, but long thin parts invariably give trouble in one way or another. Now all we need is a good flat surface, and least of all, a high polish. Any steel plate still bearing the dark scale on it, shows that it finally emerged from the steelworks in the hot state, and is, therefore, more or less free from internal stress. The most reliable material for use where distortion must not take place is known by the code of C.R. and C.A., which means cold rolled followed by close annealing. The latter operation is carried out in mass, with perhaps hundreds of sheets laid flat together, and heated up as one solid block of metal. In this mass they remain flat, but free to float or extend, and on cooling down, each sheet is completely "inert" so far as stresses are concerned. Owing to the fact that the metal faces have been in close contact all the time, air has been excluded and no excessive scaling has taken place, presenting a good matt surface free from heavy scale pitting.

Cutting Sheet Metal

Even if the sheet metal comes up to the required standard before we start to cut it, it may become badly disturbed by the time we have tortured great lumps out of it. Most shears and shearing machines are culprits in this direction, with the ordinary tinman's snips being the *worst* culprits. Wherever possible, drill and saw away the unwanted parts, taking care to support the main sheet as fully as possible whilst doing so. I know sawing is a long and tedious operation, especially on long cuts, but it is the price you have to pay in order to get the desired results.

And that is about all the help you should need to produce the platforms, other than the information given on the drawing. Painting, once more, is entirely black; no lining, no picking out with another colour—dead easy; but *please* paint the underside as well, just to satisfy me.

(*To be continued*)



Running at 70 r.p.m. on 6 in. stroke

A SHAPING ATTACHMENT FOR THE LATHE

By H. Merson

AFTER having tried out a hand-shaper I found I didn't like it. No doubt it was a handy tool, but it didn't appeal to me as a machine tool. Moreover, I really hadn't room for a shaper on the bench or anywhere else when I thought of it, but this shaper business couldn't be dismissed lightly.

I had a preference for a small power shaper, but that was out of the question in respect of first cost and also accommodation. While lounging over my lathe one day doing absolutely nothing, the idea came to me, why not make a shaper to fit on the lathe ? At first there seemed a host of snags, and the more I thought of it the more snags I could see. But soon the drawing board was out, and the obstacles were seen in better perspective.

The chief points I had to keep in mind were permissible weight, stroke of machine, as centre height was fixed, and the ability to have it going at a moments notice. As a result of my scheming, I eventually produced an attachment weighing 50 lb., maximum stroke 6 in., time for fixing up, 5 min.

Construction

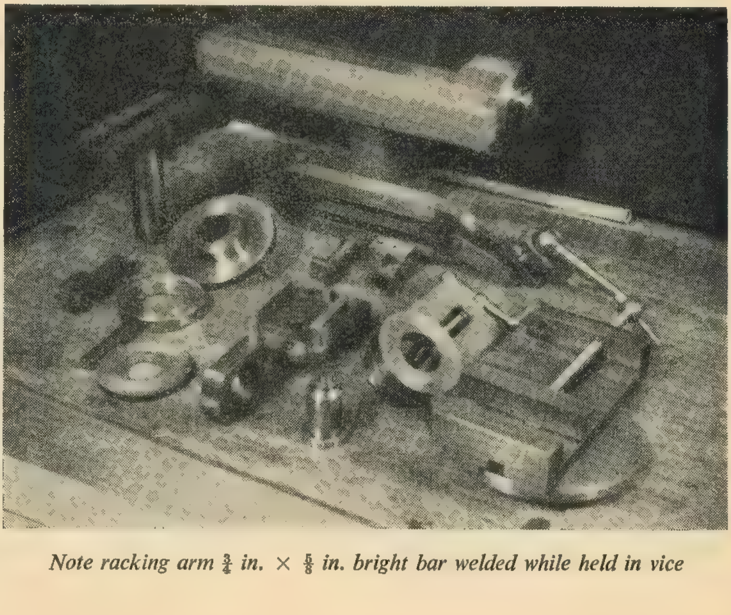
The body is made of quarter-inch steel plate, milled square in the lathe and welded together, with the various bosses. This made a strong and light structure. All driving parts are made of steel, also tool box and clapper box, etc. Ram, top slide, cross slide and table are cast-iron. No castings were used; all cast parts were made from scrap metal.

The main bearing is bushed in cast-iron, and has shown no sign of wear so far. The die block is made of phosphor bronze, and is also a good fit. The performance was better than I had ever hoped for. On steel, with 4 in. stroke, at a speed of 100 r.p.m., a cut of $\frac{1}{16}$ in. depth can be taken with a feed of 0.006 in. On short strokes, around the inch mark, 300 r.p.m. is the order, but of course this is too fast to manipulate the top slide handle when the machine is running.

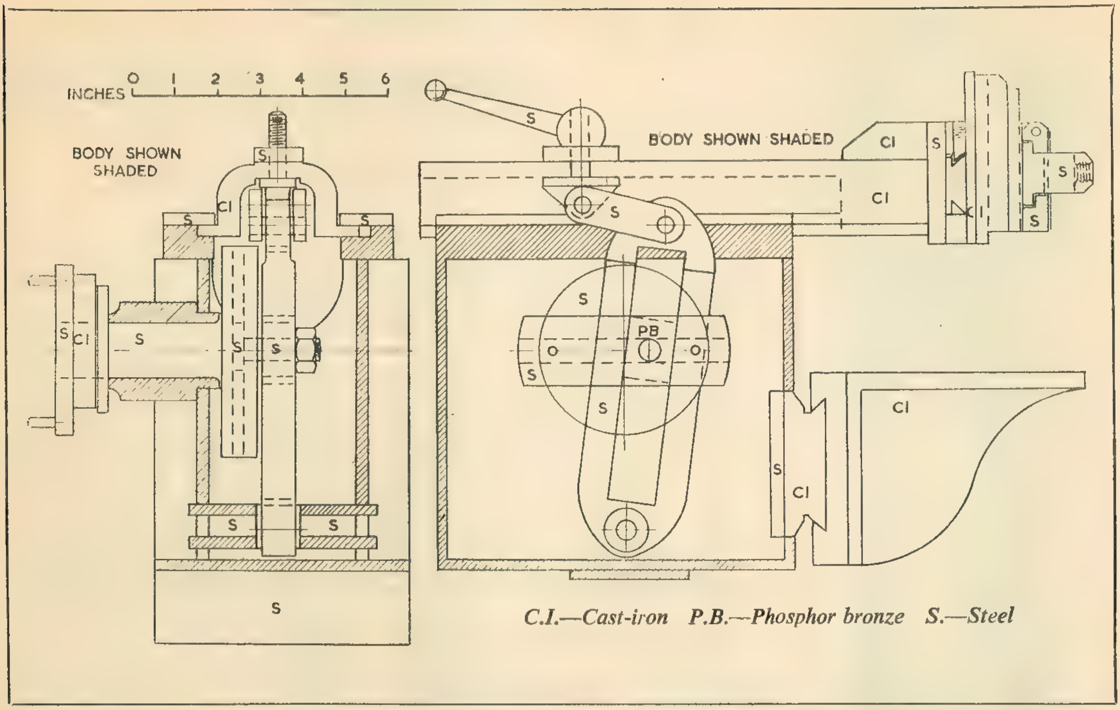
To anybody accustomed to a heavy power-driven shaper, these speeds will seem fantastic, as the usual top speed of a shaper is around 60 r.p.m., but of course, the maximum permissible speed depends on the weight of the moving parts. The main trouble with this machine, and one I have not been able to master, is catching the cuttings. Whatever precautions are taken to prevent it, the cuttings go dashing around everywhere. If I put up a baffle, they either dodge it, or hit it and dash off somewhere else. Of course, the only remedy is to go slow, but I prefer to run the machine at high speed.

Lathe Stand

I think the lathe stand I am using calls for some comment, as it may inspire some other person in the same predicament as I was to do something about it.



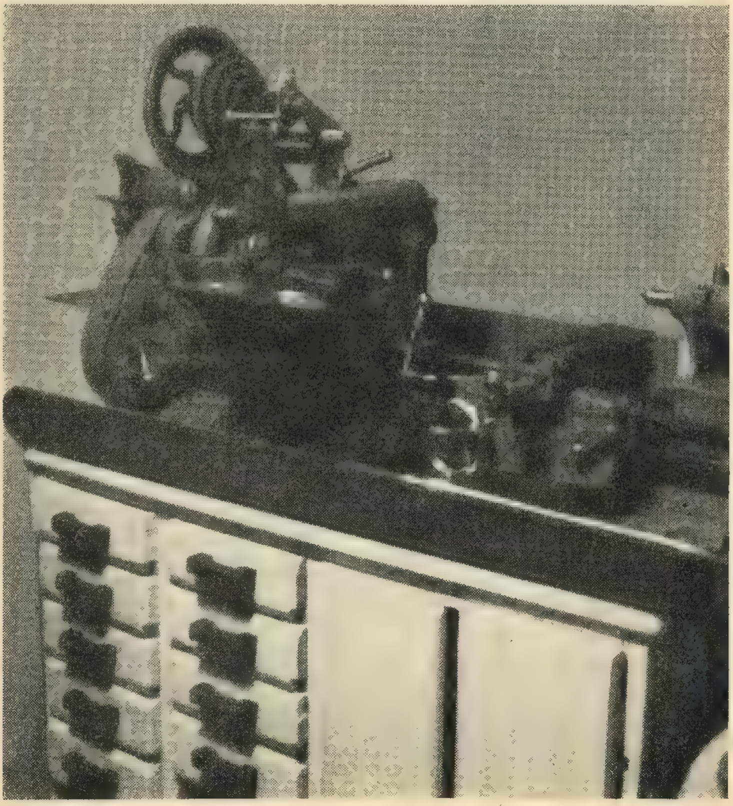
Note racking arm $\frac{3}{4}$ in. × $\frac{5}{8}$ in. bright bar welded while held in vice



The stand was made from an ordinary domestic chest-of-drawers, with six large drawers designed to hold lingerie, etc. Obviously, tools, castings and bar metal are rather different from what was originally intended to fill the drawers, so they didn't take to the treatment very well.

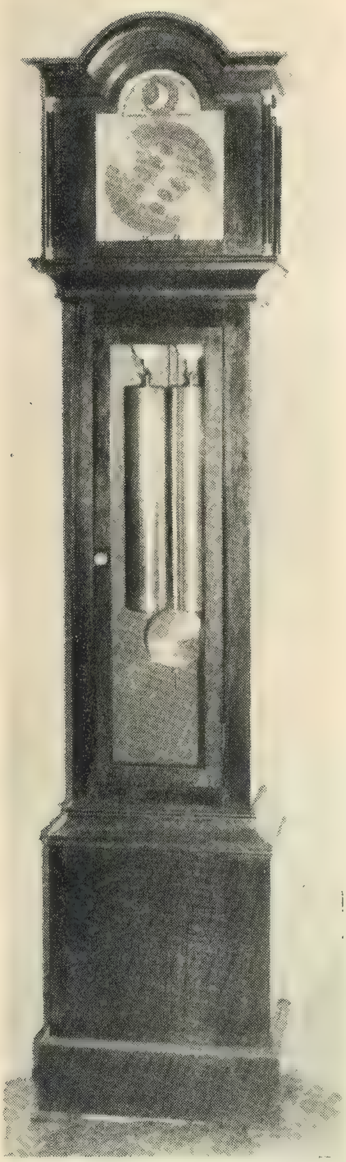
Things got into a terrible state; one drawer would open but wouldn't shut, while another would shut but wouldn't open. Another wouldn't open or shut unless you opened or closed the one below it, and you never knew when to expect the stuff in the drawer above to crash into the drawer below. Repair after repair didn't seem to be getting me anywhere; the weight was just too much for the light construction of the drawers.

One day when I was feeling a bit vicious, everything in the chest was loaded into a large trunk and all the drawers were dismantled carefully. New runners were cut and fixed in the chest, a cupboard was made at the one end, and new drawers were made of a more suitable size, and more robust construction. These drawers are glued and nailed together; the handles were cut from 1-in. mahogany and milled out on the lathe. As a result, the jamming trouble has been completely cured, and accommodation for tools and materials improved.



A successful YEAR CLOCK

By H. H. Knie (Tasmania)



A DESCRIPTION of a year clock with perpetual calendar which appeared in THE MODEL ENGINEER a couple of years ago, contributed by that modern-day genius constructor of old English clocks, C. B. Reeve, was the cause of my making one. Although horological work is not really model engineering, it is to the credit of THE MODEL ENGINEER that the subject is included. And it is through THE MODEL ENGINEER and the making of this clock that has gained me friends and helpers in this absorbing subject—friends who are separated by thousands of miles and whom I've never seen, and who are ever ready to help materially and with advice. I hope this article may help others like myself, as well as engendering greater interest in this aspect of amateur horology.

Although the yearclock is rather an advanced subject for the beginner, I hasten to say that this is a first attempt which occupied all my spare time for 16 months from movement to case. In a clock of this type, with the introduction of an extra wheel, the emphasis is on fine and careful fitting, and elimination of all unnecessary friction. As the clock is wound once annually, with the pendulum beating seconds, during which the weights, on a double line, fall only 3 ft. 3 in., emphasis on getting all parts finely fitted and freely running needs no stressing. However, the model engineer is used to meeting obstacles and challenges, and, keeping the above in mind, the job should be successfully accomplished. Actually, special horological tools are not required, although welcome, and the usual model engineer's run of tools should do most of the work. In my case the whole clock with its machining, wheel cutting, polishing, and turning the parts of the wooden case, etc., were carried out solely on an M.L.7 lathe. Practically all dial engraving (chapter ring, minute and seconds divisions and all roman numerals) were done on this lathe. No doubt similar work could be accomplished on other lathes.

For those contemplating making the clock I would refer to Mr. Reeve's articles, as I followed them out fairly closely.

The plates were cut from sheet brass, and pillars turned from $\frac{5}{8}$ in. mild-steel rod, which was quite straightforward. The next stage was turning all wheel blanks to size, and cutting the teeth. Although not so difficult, this section may stump many a trier. It would be possible to have the wheels professionally cut, but I think the modeller would prefer to do this himself. All my cutting was done on the Myford indexing head, even to making a division plate to give me a couple of combinations not available on the standard equipment.

At this stage it is well for the prospective gear cutter to know a little about the subject. Many helpful details are given in *Gear Wheels and Gear Cutting*, published by Percival Marshall and Co., which helped me quite a lot. The actual cutters were of the commercial variety which can be obtained from certain horological dealers. Here it is necessary to know what is required before ordering. Nowadays most clock-wheel cutters are made to the module unit of size as distinct from diametral pitch. Cutters based on the module are usually measured in millimetres, while d.p. is confined to inches. By d.p. is meant so many teeth in a wheel per inch of pitch diameter: e.g., 40 d.p. means 40 teeth on the circumference for each inch of diameter; a 40-tooth wheel of 1 in. pitch diameter is cut by a 40 d.p. cutter; an 80-tooth wheel of 40 d.p. will have a pitch diameter of 2 in. Module on the other hand is dividing the pitch diameter by the number of teeth. It is actually the reciprocal or reverse of d.p., and usually the pitch diameter is measured in mm. instead of inches. For purposes of comparison, we will take a 50 d.p. cutter and convert it to module size. 50 d.p. means 50 teeth per inch of pitch diameter. Converting to module we proceed thus: Divide 50 into 1 in., or more correctly 25.4 mm. and we get 0.5008 which is the equivalent module to 50 d.p.

Clock gears are practically all of the epicycloidal form as distinct from involute, and cutters in England today are being made in sets of eight for each pitch, so in ordering cutters it is essential to state the number of teeth requiring a cutter to cut, as well as its module or d.p. size. As most of the teeth required are usually over 55 and under 135, one cutter per pitch is all that is needed. The year clock was constructed with only four cutters. It is only in the low numbered teeth that more cutters are required. For example, No. 8 cutter cuts gears of 12 to 13 teeth only, while cutter No. 2 cuts 55 to 134. Cutter No. 1 cuts from 135 to rack.

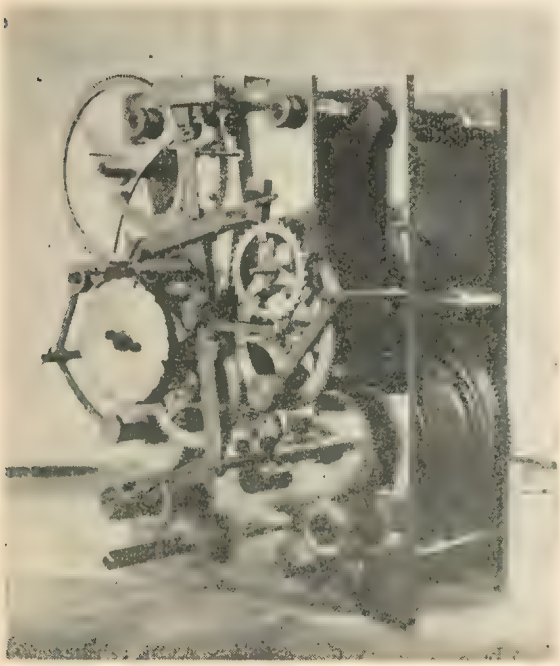
In the foregoing, all reference has been to pitch diameter. In turning

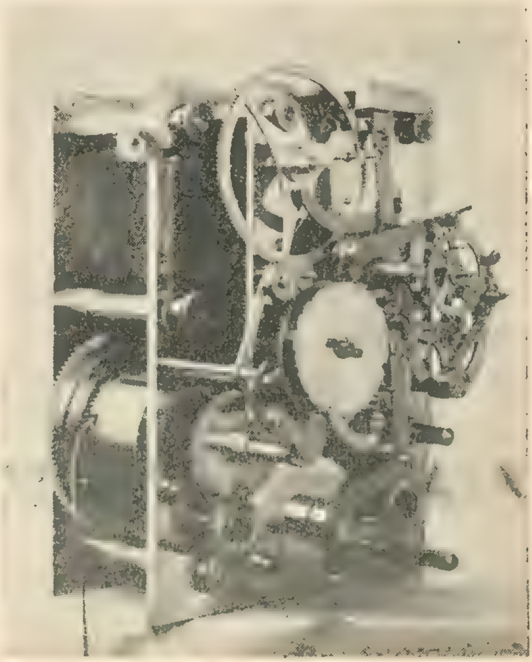
blanks to size the actual diameter is larger, known as outside diameter. This can be readily understood when it is realised that the teeth are cut into the blanks and the actual pitch diameter must be smaller. Usually in calculating o.d., two extra teeth are added to the number to be cut and divided by the diametral pitch. This gives the o.d.

Cost of cutters is not great, being about 15s. each. However, the amateur can make his own by shaping up suitable fly cutters.

For cutting the scape wheel, month wheel, week wheel and four-year cam, a suitably shaped fly cutter was used. Practically the rest of the components were made up as per Mr. Reeve's article. For the *maintaining* springs I found unhardened car spring admirable. These were cut and filed to shape and finally hardened and suitably tempered. Pinions were made from pinion wire according to Mr. Reeve's method. Although the orthodox clockmaker does not follow this method, I can assure anyone it leaves nothing to be desired. Extra care is needed in cutting the scape wheel. Teeth must be evenly spaced and the wheel mounted truly concentric on its arbor. Pitching the train presented a poser. Clockmakers use an appliance known as

Showing the excellent workmanship in the dial of the year clock





Two views of the movement of the year clock

a depth tool which the writer did not possess. Other means had to be found, and eventually a tool was made which answered the purpose admirably. A frame of four mild-steel blocks, and ¼ in. steel rod was used. The blocks were of ½ in. square steel by 1 in. Quarter-inch holes were drilled in each at right-angles to each other and fitted with set-screws. Four ¼ in. rods were made a sliding fit. When fitted together it was possible to form a rectangular figure which could be enlarged or reduced. On the parallel rods of this frame a pair of other blocks were fitted with set-screws and drilled to take the particular size pivots of a wheel. With each wheel mounted in its pair of blocks, it is easy to see that they could be moved closer or further apart from one another, thus securing the correct depth. The opposite pair of rods are used to adjust the tool to the correct width of wheel, making it adaptable to any size clock. By making the tool large enough and using a pair of sliding blocks for each wheel, the whole train can be depthed in one operation. Once the correct depth is obtained, the blocks are locked in position by set-screws. It is easy to see now that if one side of this frame is removed with all blocks secured in position, it can be clamped and located on the prepared clock plates and becomes a drilling jig locating all holes correctly. The tool is easily and quickly made and does not demand the accuracy needed in making as in the correct appliance.

The train now being successfully planted, the escapement was next tackled. This was a Graham dead beat, which demands careful and accurate fitting. The pallet arbor is mounted in an eccentric bush to secure that fine depth adjustment necessary. The pallets were turned from a steel ring and the arcs were cut out and secured with a set-screw as a brass yoke. Here again for the novice it is advisable to make these adjustable to secure that measure of adjustment which spells success or failure.

Pallet thickness is half the width between the scape wheel teeth, less sufficient for clearance or drop. The drop must be only enough for clearance. Drop represents waste power, but it cannot be avoided. The escaping arc must be kept small, as the larger it is the more power required for impulse, which simply cannot be provided in a clock such as this. However, a small pendulum saving is not only desirable but essential for good time-keeping, as it keeps to a minimum the influences affecting good time-keeping—circular error to name one. Total pendulum swing at the rating nut should not exceed 2 in. or 1½ deg.

At this stage a temporary pendulum was fitted and the clock got going. It was left thus while the motion work and calendar unit was tackled. This section is quite straightforward, the action of which is explained in Mr. Reeve's article. A modification was introduced to the four year cam which appears to have successfully overcome the use of shutters on the deep slots in this wheel, and elimination of a lifting finger on the year wheel to assist the bell-crank lever-pin to clear successfully the slots.

The dials were turned from brass sheet, and all straight-line engraving was done on the lathe with the aid of the indexing head. The thick lines of the roman numerals were lightly engraved by a parting-off tool. They were then sawn and filed out. Finally, all engraving was filled with black wax. The case was made from Tasmanian blackwood.

The clock has now been going for several months and keeps a very consistent rate, the pendulum being of invar, and tripping over the date at midnight with unfailing regularity.

I wish to take this opportunity of thanking Mr. Reeve (an amateur's friend), for his wonderful help in making this clock possible.

JUDGING EXHIBITION MODELS

THE number of letters that came to us as a result of the comments by "L.B.S.C." in his article of November 26th preclude the possibility of publishing them; but the writers can be assured that each letter was read with the greatest interest, and we thank everybody who contributed to the correspondence. The opinions expressed were about equally divided between agreement and disagreement with "L.B.S.C."; but it is clear that there exists a great deal of confusion as to the underlying policy of the judges at the "M.E." Exhibition, and the following observations may clear the air on this.

The basic principle is that each exhibit in the Competition section is judged on its merits as a piece of craftsmanship, and that applies to the simplest as well as to the most elaborate exhibit in whatever section it is entered. But—and this is where the confusion undoubtedly arises—it is by no means a foregone conclusion that the elaborate job will win over the simpler one on *all* counts. It all depends upon how the exhibitor has applied his skill and his knowledge of the use of tools.

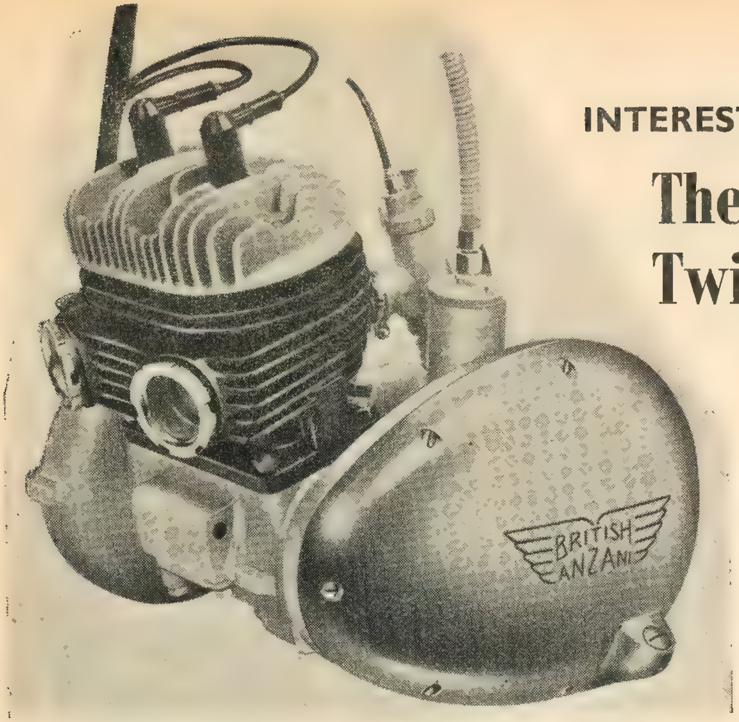
A very high finish is something far removed from *correct* finish and is, therefore, likely to lose a lot of marks. But the man who obviously takes pains to achieve a realistic degree of finish in metal parts, and paint, scores heavily over both the man who does not trouble to achieve any degree of finish at all and the one who wastes a lot of time and energy in the highest possible degree of finish in a working model.

Incidentally, a "glass-case" job does not necessarily have an advantage over a working model; each is judged on its merits. But the plain fact is, that in *each* case, the nearer the model is to being a replica of its prototype, pictorially as well as mechanically, the greater the merit. It does not necessarily entail making every working part and all details exactly to scale in a working model; this is, in fact, more often than not, impossible or, at least, very undesirable. For example, footplate fittings, in 1-inch scale and smaller, can not be made workable and exactly to scale, if they are to give satisfactory service for any length of time; what really matters is that their arrangement should be convenient, neat and tidy, and that the workmanship put into their construction should be good.

The representation of wheel tyres is quite a "bone of contention," which is surprising after the number of times that the correct method has been described and illustrated in THE MODEL ENGINEER. Our good friend "L.B.S.C." has dealt with it more than once, and if competitors always followed his instructions, the results would be satisfactory.

Finally, several correspondents have suggested, first, that there should be two classes in the competition: one for working models, the other for "glass-case" jobs; also, that the working models should be tested under power to prove that they work properly. The answer to this is that the two classes suggested already exist, and have done for many years; also, that to test every working model in the exhibition is quite impracticable.

If a man has succeeded in producing a working job which, at the same time, is a very close copy of its prototype, then he obviously deserves more credit than one who has not taken this trouble.



The unit is of remarkably clean design. Note the generously finned cylinder

INTERESTING I.C. ENGINES

The new ANZANI Twin Two-stroke

By J. D. McLintock

THE name of Anzani has long been famous in connection with engines developing high power-ratings for their size. One remembers with some affection the early Anzani four-stroke engines fitted to sports and record-breaking motor-cycles, and sometimes, if memory serves correctly, to three-wheelers.

In more recent times, the name has been well known for highly successful marine outboard engines and small units used on mechanised agricultural plant.

The company's latest venture is of particular interest, not only because it represents a re-entry into the motor-cycle field, but because the design is ingenious, clean, and appealing. The unit was seen at the 1953 Motor Cycle Show, and will be fitted to Tandon and Greeves machines, which may both be classed as sporting lightweights. The writer has visited the Hampton works of the firm, and has seen the first one or two engines. Production is already getting into its stride, and the company is sufficiently well tooled-up to ensure a steady flow of production in a short time. Although the motor is based on an existing marine design, it was not, after all, found possible to use many identical parts when all the necessary modifications had been made—as is the way with such things.

The engine is a side-by-side vertical two-stroke twin. There are separate crankcases, and alternate firing, whilst the most interesting feature of all is the rotary induction valve, which, it is stated, allows a more generous inlet timing, and avoids the possibility of blow-back—a fault quite common in more conventional two-stroke designs. Arrangements for transfer of the charge are also to some extent unconventional, in that a ported piston is used.

The crankcase halves are split horizontally instead of vertically, as is more usual. The lower casting consists of two crankcases alongside, to all intents and purposes, and these are separated by a central induction chamber and a wide plain main-bearing. This casting also houses the main outer bearings, and the necessary compression seals, etc.

The crankshaft is of the built-up type, with full flywheel webs, and pressed-in crankpins. The shaft has large-bore drillings which extend at an angle into the crank webs, and these register with a port in the large bearing which surrounds the shaft when the assembly has been made up. Thus the shaft acts as a rotary inlet-valve, passing fuel from the induction chamber through the flywheel webs to each crankcase in turn.

The upper shell of the crankcase is of much the same design as the lower, but, of course, has openings for the pistons and rods. It is retained by eight studs and nuts, and there are wide flanges.

One of the prototype designs had an aluminium cylinder block with chromium-plated bores, but this was found to be a most expensive business, although very effective, and the production job has cast-iron cylinders and is heavily finned. Each cylinder has a single exhaust port at an angle of 15 deg., and the exhaust pipes are of 1⅜ in. diameter.

Domed pistons each carry two compression-rings but no scrapers. Six bolts retain a one-piece alloy cylinder-head. The induction pipe is a long, downdraught one, and is bolted to the crankcase with a generous flange. The crankcase itself is, of course, cast so as to provide a suitable passage to the induction chamber already mentioned.

Generally speaking, the rest of the unit is fairly normal.

An Albion foot-change four-speed gearbox is used, and is bolted to the back of the engine. A duplex primary chain runs in a stout aluminium oilbath chaincase, and a notable feature is that the extension of the crankshaft, beyond the drive sprocket, is supported by a double-row ball outrigger bearing which is housed in the chaincase.

Ignition and lighting current are provided by a Wico-Pacy flywheel generator. The complete power unit has a width of approximately 14 in. and as normally fitted, the cylinders have a forward inclination of 15 degrees. Power output in normal form is stated to be 10 b.h.p., but the unit is likely to lend itself well to "hotting up." Such is, in fact, the view of Mr. C. Harrison, a director of the company and a man keenly interested in motor-cycles and in racing outboards, and who spent his early days with the famous J.A.P. concern. Mr. Harrison, incidentally, races a beautiful little craft which was made by a case-maker in his own export packing department, and which is as nearly as possible of all-glued construction. Its racing engine has been highly successful, and it may be a point of interest and controversy that the ports are not polished !

Unusual Old Steam Engines

DETAILS FROM AN ENGINE LOVER'S NOTEBOOK

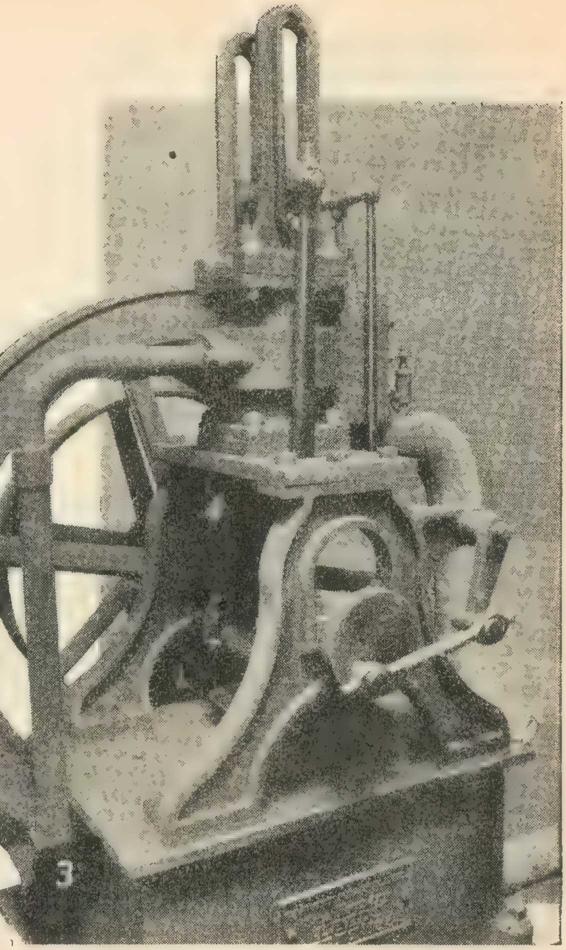
By "Student"

THE love of the steam engine is a sentiment that never leaves the one it embraces. Such, indeed, has been my experience, as after many years of research in steam engine history, the interest is as keen as ever to find the rare or unusual ones. Naturally, in this some stand out before others; a few notes upon some of them may interest readers.

Photograph 1. This little gem was an engine house of the Kent Water Co., and in operation about 1866, so that it is of late design. It housed two Bull type pumping engines, the steam cylinders being upon the top floor. The house was about 35 ft. high, being "L" shape in plan, and its massive buttress, the fine stonework about them and the window apertures were as delightful as the external staircase turret at the left, which gave access to the engine operating floor above. This turret was circular in plan, the free-stone centre band being level with the window ledges. The entry door can just be seen beside the cast-iron air vessel for the pumps. The chimney was fully in keeping, being of similar stone, with a massive freestone cap of similar moulding to the turret cap, but with an added circular motif beneath, like that of the main chimney top above. The boiler house, seen behind the turret, was, too, in keeping with the general scheme. It housed four Cornish boilers, which worked at 35 lb. per sq. in.

The engines (Photograph 1A) were by Harveys, of Hayle, Cornwall, and were a simple steam cylinder placed upon the upper floor, the piston-rod coming through the bottom cover, directly down to the pumps below, there being a very heavy weight upon the crosshead, which equalised the load, as the engine was single acting. The well pumps were worked from the cross-head by links, each engine having its own well, and surface lifts.

No. 1 engine, was dated 1868, and was 40 in. bore by 8 ft. stroke, whilst its companion was of 50 in. bore, and 9 ft. stroke, having been installed in 1871. The well pump beams were of wrought-iron. The whole plant was diesel-electrified about 1937.



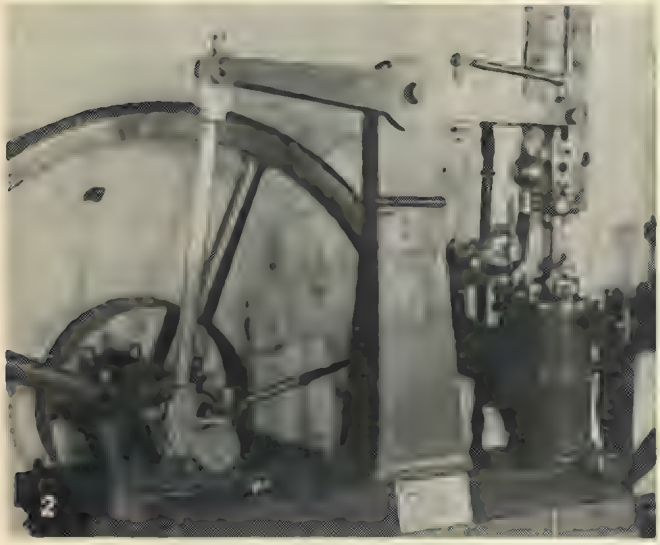
A Carrett-Marshall Table engine formerly in a London Brewery

Photograph 2. The loss of this engine is much regretted, as it was at the premises of the Norwich Model Engineers Society, when they were wrecked. The society had rescued it from dereliction, only to lose it, and much more. The beam was 2 ft. 7 in. centres, con-rod 2 ft. 6 in., the cylinder being 5½ in. bore, and 8 in. stroke. It was built in Norwich, and the parallel motion was an uncommon type.

Photograph 3. This cheery little table engine once drove a section of a London brewery. It was built by Carrett-Marshalls, of Leeds, in 1859, who, at that time used the form for driving, or as a feed pump, with the ram beneath the crankshaft. Its total height from the bottom of the tank bed was less than 6 ft., the side connecting-rods were 2 ft. 9 in. long, the one-piece flywheel was 4 ft. in diameter, whilst the slide valve cylinder was about 5 in. bore, and 9 in. stroke; it was non-condensing. Carrett-Marshalls later became Hathorn-Daveys, world famous for pumping machinery, and Sun Foundry still carries on the tradition.

Photograph 4. A rare bird this, as it is a bell-crank engine, which once drove machinery in the carpenters shop of a London works. It was of great age, and, except that the flywheel shaft had necessarily to be separate, was truly portable, as the condenser, air pump, cylinder, governor, and all motion were connected to the tank bed. Cylinder was about 14 in. bore, and 26 in. stroke, the slide-valve being of the old long "D" form, in which the valve was a trunk for the exhaust steam. It had long been disused, and no record of its maker or date existed.

Photograph 5. This beam engine, stated to be made by F. C. Baker of Southwark about 1870, for many years drove pumps for a London hospital, by gearing to a three throw crankshaft below. It was of the slide-valve condensing type, bore



(1 *and* 1A). *Exterior and interior views of the engine house of the Kent Water Co.*

(2) *A beam engine formerly owned by the Norwich M.E.S.*

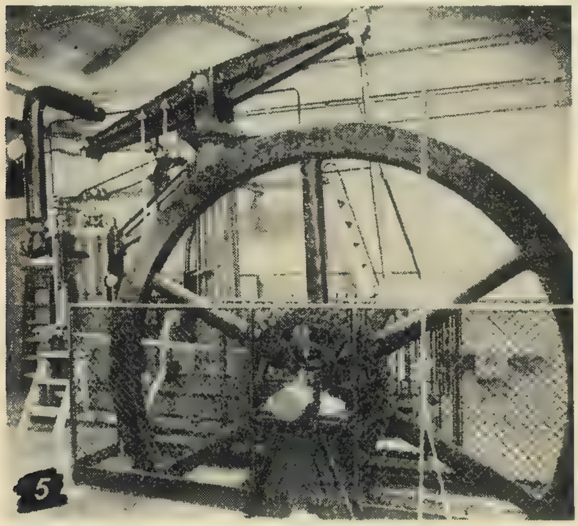
(4) *An unusual type of bell crank engine*

about 18 in. and 3 ft. stroke, and the fluted column reminds one of Simpson design, yet in all else, it is individual; the use of a cast iron strut from the cylinder to the column, is unusual, as, too, is the parallel motion. The beam was 9 ft. centres, the main centre being 10 ft. 6 in. above the floor, and the flywheel was 11 ft. in diameter. Here, too, all is now electrified.

Photograph 6. This was in a dismantled Lancashire bleach works, which being a much more spacious layout than a mill, and with widely scattered power points was often better with a small engine here, and there, at the ends of the works, than with long ranges of shafting. There is a possibility that it drove the mechanics shop. It was rather slender in design, and was of the condensing type the bore being 15 in., and stroke 3 ft. 6 in., and although the steam was, at times as low as 30 lb. per sq. in., was quite powerful. The upper entablature carrying the beam bearings was fitted to the columns by internal pins, and cotters, and the cottered beam end caps, and cast-iron crosshead and connecting-rod, together with the method of casting wrought-iron arms into the flywheel boss, and circular section rim, are very old industrial engine practice. The fluting around the upper end of the connecting-rod was an individual touch, whilst the dead square bends on the exhaust pipe remind us that the early cast-irons flowed very well. Although the governor stand reminds one of Rothwell's practice, there is little else to do so.

Photograph 7 is of another Blitz victim, which drove a Surrey engineering works, in combination with a water wheel, which was about 20 ft. in diameter, and 6 ft. in width. This little grasshopper engine, like many others, was most likely made at the works it drove, as there is little that is characteristic in the design. In fact it is eminently individual, as the long "D" valve was uncommon at later date, and the use of "A" frames (to support the radius-rod of the parallel motion) which reached to the bed-plate, instead of bedding upon the cylinder top flanges, is unusual. It was steamed, when the water was low, by a vertical boiler, about 12 ft. high, and 4 ft. 6 in. in diameter, but the water power was valuable.

(To be continued)



(5) *A beam engine by F. C. Baker, of Southwark*

(6) *Another beam engine from a Lancashire bleach works*

(7) *A grasshopper engine from a Surrey Engineering works*

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Painting a "Rocket"

I have recently purchased a small model of Stephenson's "Rocket." Could you please give me some idea of the colour scheme?

R.B.M. (Cradley Heath).

The "Rocket" as represented by a full-size model which stands alongside the original engine in South Kensington Museum, is painted in the following manner. The boiler is yellow, with cleading bands painted black. The chimney is white and the wheels are yellow. The frames are black. The tender is painted a darkish green and has yellow wheels, while the water barrel is finished in varnished wood with black hoops. We would add that the front of the boiler and the small smokebox at the base of the chimney are painted black.

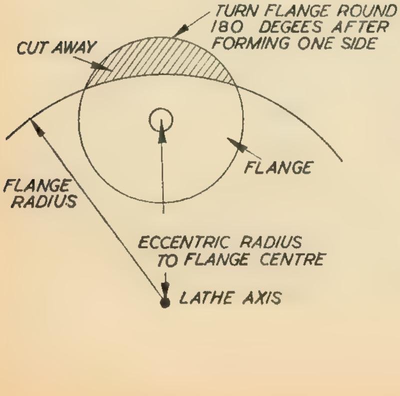
Forming Cams and Flanges

Would you please inform me of the method used in forming convex flanked cams for petrol engines. I read in the article on "Utility Steam Engines" in THE MODEL ENGINEER *that the same method was used in shaping oval flanges, and I should be very pleased if you would give me a rough sketch of the method used.*

T.R. (Swansea).

The process of forming convex flanked cams for petrol engines entails the use of a special eccentric turning jig which enables the flank contours to be turned in the lathe to an appropriate radius with an ordinary turning tool. A detailed article on the machinine of a 4-cylinder engine camshaft was published in the issue of THE MODEL ENGINEER, dated May 15th, 1947.

The same method can be quite easily applied to turning the sides of oval flanges, and the sketch herewith shows how the flange should be set up. If a number of flanges have to be dealt with, they could be mounted on a pin, set up eccentrically on the faceplate or in the lathe chuck. It would also be possible to devise a method of indexing the flange exactly 180 deg. after the first cut has been taken.



3½-in. Gauge Loco Boiler

I am making the locomotive "Marina," and wondered if I could use some tube I have in stock for the boiler. In the first place it is the wrong gauge, mine is 15 gauge (13 gauge is specified); also, it is 4-in. outside diameter, and with the taper boiler the firebox end is 4⅜-in. outside diameter. If I split the tube and close riveted a strip inside and brazed, would this be suitable?

L.G.L. (London, S.W.15).

Although 15-gauge tube is rather on the thin side for a 3½-in. gauge locomotive boiler, we feel that, provided the workmanship is good, it should be strong enough to give you a satisfactory boiler. We would advise, however, that the tube plates should not be thinner than their specified size, and we also suggest that the working pressure should be kept down to 60 lb. per square inch. We would add that we would not advise you to split the tube, but to use a plain cylindrical boiler barrel and build up its proper shape from thin sheet outside.

Converting Model I.C. Engine

I have a 5.9 c.c. model petrol engine which has not given very satisfactory results. It is a 2-stroke engine having a bore of 0.75 in., stroke 0.815 in. I should be grateful to know if it is possible to convert this engine into a compression-ignition engine. I have facilities for machining new piston, cylinder-head, etc., but lack the knowledge of dimensions, shape of piston head, etc. Will you inform me if there are any books published on the construction of these engines?

R.J. (Twerton).

It is by no means certain that this engine could be satisfactorily converted. In the first place, few successful compression-ignition engines of this capacity have been constructed, and the general structure of a compression-ignition engine needs to be much more robust than the normal petrol engine because of the higher pressures involved.

We do not know of any books on the construction of diesel engines in this size, and comparatively little has ever been written that would be useful to you in such a conversion.

Compression Pressures in I.C. Engines

Please tell me what is the normal compression ratio and maximum combustion pressure of (a) 2-stroke engines, and (b) 4-stroke engines under full load with wide open throttle. I understand that compression pressure will depend on compression ratio and volumetric efficiency, but there must be a normal figure obtained in practice, just as h.p. is average for each size of engine. Could you give me the title of a text book dealing with the design and theory of i.c. engines?

I.W. (Newtownbutler).

There is no definite standard for compression pressure and combustion pressure in either 2-stroke or 4-stroke engines. Your suggestion that h.p. is average for each size of engine is not strictly correct, as this figure varies very widely in engines of a given capacity.

Assuming that an engine has a compression of 6 : 1, the compression pressure, based on 100 per cent. volumetric efficiency, will be 6 atmospheres (absolute) one atmosphere being roughly assumed to be 15 lb. per sq. in. The pressure will thus be 90 lb. per sq. in. absolute, or 75 above atmospheric.

With normal fuels, combustion pressure is usually from three to four times compression pressure, but when special fuels are used, these figures do not necessarily hold good.

With reference to a text book dealing with the design and theory of i.c. engines, we suggest that Ricardo's work on *High-speed Internal Combustion Engines*, in two volumes, is one of the most authoritative books on the subject.

L.B.S.C.'s *Titfield Thunderbolt*

IN $3\frac{1}{2}$ AND 5 INCH GAUGES

FROM this stage onwards, the work on the two boilers is much of a muchness, so it will be possible to combine the two jobs into one lot of notes, without the likelihood of anybody getting into a tangle. I've already mentioned, in the last instalment, about making the backhead and smokebox tubeplate for the 5-in. boiler; builders of the $3\frac{1}{2}$-in. engine can now make theirs as well, as the smokebox tubeplate is needed as a spacer when fitting the nest of tubes. For this, you'll want a circular former plate $2\frac{5}{8}$ in. diameter, and a disc of 16-gauge sheet copper $3\frac{1}{4}$ in. diameter. Clamp together in the bench vice, and flange the copper over the former as usual, then chuck the embryo tubeplate in the three-jaw, flange outwards, and skim off the ragged edge. Reverse, and hold on the edge of the outside jaws, to turn the flange to a tight fit in the boiler barrel. Drill and tap the stay and steampipe holes as shown, and locate the tube holes from the firebox former, clamping the former to the tubeplate so that the bottom hole is a bare $\frac{1}{4}$ in. from flange. This will allow the lowest tube to clear by a narrow margin. Drill and ream for tubes and flue, same as for firebox, but this time, put the reamer well through, as the tubes should fit easily when inserting the tubeplate in the barrel. They stand a chance of distorting, if they don't. Countersink the holes on both sides of the plate.

The backhead for the $3\frac{1}{2}$-in. gauge engine will require a piece of 16-gauge sheet copper measuring $5\frac{1}{4}$ in. $\times$ $3\frac{1}{2}$ in. Bend up $\frac{5}{16}$ in. of each long side, to form the flanges; no backhead former is needed, as this little job can easily be done in the bench vice. Bushes will be required for the fittings, as 16-gauge copper is too thin for direct screwing; so look up the drawing in January 14th issue, and drill $\frac{5}{16}$ in. holes at the points indicated. Tip for beginners—if you attempt to drill these straight from the centrepops, it's a million dollars to a pinch of snuff that the holes will not only be polysided, but will finish in the wrong places. To avoid that, drill first with a No. 30 or $\frac{1}{8}$-in. drill, enlarge with 19/64-in. and finish with a $\frac{5}{16}$-in. reamer. The hole for the regulator bush is made as described for the holes for superheater flues, but to $\frac{3}{4}$ in. diameter. Use a reamer to finish, if you have one that size.

Although the bushes need not be squeezed in until the backhead is fitted to the boiler, they can be made at this stage. The best material to use for bushes, is copper; either cast or drawn rod, or thick-walled tube. I use these materials myself. If not available, bronze or gunmetal rod will do, or the metal from which plumbers' weldable fittings are made, but don't use brass; I've had complaints from builders who have tried to braze or silver-solder brass bushes into a boiler, that the bushes have become so shy at the sight of a blowlamp, that they have discreetly vanished. They were probably made of the alloy known in the metal trade as "screw-rod," which will take a lovely thread, but has a very low melting-point. Novices cannot distinguish it from hard brass at a glance, and metal merchants usually supply it when just "brass" is asked for. When making $\frac{1}{4}$ in. $\times$ 40 bushes from rod material, my method is to chuck in three-jaw, face the end, centre, drill a little deeper than thickness of bush required, with a 7/32-in. drill, turn the step to a tight fit in the hole in the plate, part off to leave a flange a full $\frac{1}{16}$ in. thick, reverse in chuck, put a $\frac{1}{4}$ in. $\times$ 40 tap right through, and skim the flange truly. It's much easier to tap a thoroughfare hole than a blind one! Don't grip the bush so tightly that it is distorted.

The hole for the firehole ring cannot be located and cut in the backhead, until the firebox and tubes have been erected in the boiler shell; but the six holes for the staybolts can be drilled, at the same location as shown on the front of the firebox shell. Drill three extra, in another row at $\frac{9}{16}$ in. above them, on the same vertical lines.

Tubes and Flues

The firetubes and superheater flues are the same diameter on both boilers, viz: $\frac{3}{8}$ in. and 1 in. respectively. The $3\frac{1}{2}$-in. boiler needs seven small and one large; and the 5-in. boiler, thirteen small and two large. True up and clean the ends in the lathe. If the hole through the mandrel isn't large enough to take them, hold one end in the three-jaw, and support the outer end in an improvised wooden steady, made in a few minutes. Screw two bits of wood together at right-angles, and put a coach-bolt through one, so that the steady can be held down to the lathe bed, or the saddle. Put a $\frac{3}{8}$-in. drill in the three-jaw, and run the steady up to it, letting the drill go through the wood. Then proceed as shown in the sketch. After doing all the small tubes, put a 1-in. drill in the chuck, and enlarge the hole in the steady, to take the flues, which are faced off same way. Clean the ends of tubes and flues with a bit of coarse emerycloth or similar abrasive; a very scratchy surface is the finest you can have, for silver-soldered tube joints, the scratches forming a perfect "key."

Insert the tubes and flues into the holes in the firebox tubeplate, letting them project through about 1/32 in. and then put the smokebox tubeplate on the outer end, to act as support and spacer while the silver-soldering job is in progress. Carefully line up the tubes with the sides of the firebox, and see that they are square with the tubeplate. The whole lot can then be silver-soldered at one heat. Every tube on the $3\frac{1}{2}$-in. gauge boiler, is easily accessible; and although there are a lot more in the 5-in. job, every one can be seen, and if the tubeplate is evenly heated with a big diffused flame, as mentioned a little further on, there will be no difficulty in getting a perfect fillet of silver-solder all around every one. Stand the firebox and tube assembly in the brazing pan, with the tubes pointing skyward; pile small coke or breeze all around the firebox, to the level of the tubeplate, and put some inside as well, to within about 1 in. of the tube ends. Mix up some Easyflo flux, or powdered borax, to a creamy paste with a little water,

and put plenty of this all around the tubes where they enter the holes in the tubeplate. On the $3\frac{1}{2}$-in. gauge boiler, the silver-solder, or Easyflo, can be applied direct from the strip; but on the larger one, the best thing to do, is to cut some little bits about $\frac{1}{8}$ in. square, and drop them in the flux around the tube ends.

SOS

Now, as the gentlemen on the radio who refers to Lady Godiva's home town as " Cuvventrah " would announce, " Here is an SOS. Will everyone concerned, please note that an oxy-acetylene blowpipe should never be used for silver-soldering tubes in a small boiler. I will repeat that—*will everyone concerned, please note that an oxy-acetylene blowpipe should never be used for silver-soldering tubes in a small boiler.* That is the end of the SOS "—and it might well be the end of the boiler ! Never mind about what you've read or heard to the contrary; the above is pure gospel, and when Curly makes an emphatic statement, it is in the interests of the followers of these notes. I don't make them just for the sake of being contrary, or through perverseness, or just because I don't happen to love the person who " says different." I just offer you the results of my own personal experience, and have not only made quite a lot of boilers myself, but have seen the woeful results of following the methods of others with far less experience. My correspondence has told many a tale !

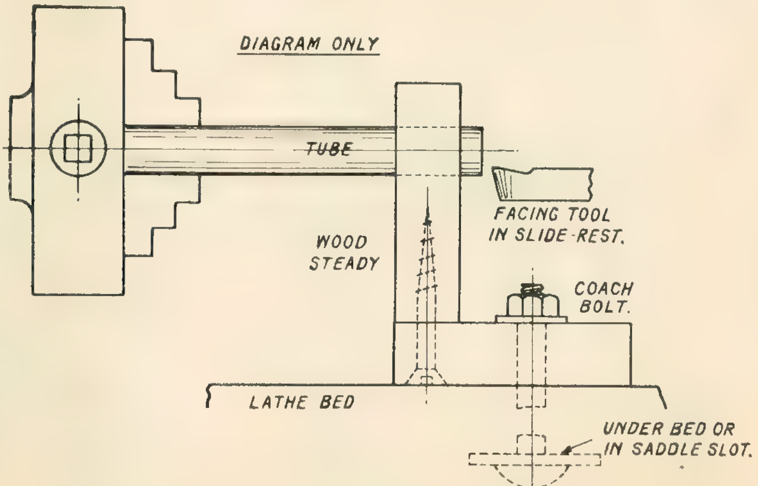
The safest way of doing the job, is as follows. With a blowlamp, or an air-gas blowpipe, heat up the whole of the tubeplate, keeping the flame off the tubes as much as possible, while blowing partly inside the box, and partly outside. When the coke or breeze glows red, and will retain the tubeplate at a good temperature, heat up the tubes at the point where they enter the tubeplate; they will redden for about an inch up. Now, if you gradually increase the heat, until the whole lot glows red, you will find, on the larger boiler, that the bits of silver-solder among the tubes, will melt and run, " flashing " around the tubes and forming a fillet. On the smaller boiler, apply a strip of silver-solder (best grade) or Easyflo, to each tube, and a little will melt and run around. If the flame is then directed on to the tubeplate, inside the firebox, for half-a-minute or so, it will give the molten metal a chance to " sweat " through the joint, and there will be no risk of either burning the thin tubes, or " boiling up " the silver-solder, which should show as a fine silvery ring around each tube end. Let the job cool to black, before putting it in the pickle.

The only safe way—and I'll repeat that too; *safe way*—to fix thin tubes with silver-solder, is to use a big " soft " diffused flame, such as is given by a blowlamp, or an air-gas blowpipe. I can get the right sort of flame with my oxy-coal-gas blowpipe, and I have put in several sets of tubes with it, but I prefer the blowlamp, and I most certainly wouldn't recommend the average follower of these notes, to use anything else. I don't assert for one minute, that the job *cannot* be done with an oxy-acetylene blowpipe; but to get the kind of flame required, would need a very large tip, and very low gas pressure, plus experienced judgment. It is possible to crack a nut with a steam hammer, without bruising the kernel; but that is no reason why you should be advised to use a steam hammer for the job ! A slight misjudgment of the flame temperature, will result in either burnt tubes, a spongy and porous joint, or both; and in my humble opinion, the game isn't worth the candle. I have seen the results obtained by several folk who thought that they " knew all the answers "; and have also received letters from correspondents, asking why the silver-solder " boiled and bubbled," and refused to lie in an even fillet all around the tubes, when they were sure that they had plenty of heat. I'll say that they had—just another case of " too much of a good thing " ! I always enjoy a good-natured and friendly chuckle when somebody or other starts in to give instructions on " revolutionary " methods of boiler construction, and various other items connected with locomotive-building. Everybody knows quite well, that a new office-boy, after a month's experience, can run the business far better than the managing director !

After doing the job by the method which your humble servant has found most satisfactory, and noting that the silvery ring is showing around each tube inside the firebox, pull off the smokebox tubeplate, and heat up about an inch of the ends of the tubes, to dull red. The whole assembly can then be pickled for about 20 minutes, washed off, and cleaned up ready for the next operation.

How to Fit the " Inside "

Both $3\frac{1}{2}$-in. and 5-in. boilers are assembled in the same way. First, clean every place where the metal will come in contact. Cut a piece of copper rod to fit between the sides of the firebox shell, at the front end; this will be $\frac{1}{4}$ in. square on the larger boiler, and $\frac{1}{4}$ in. $\times$ $\frac{3}{16}$ in. on the smaller one. Clean and slightly bevel opposite sides, and attach it to the bottom of what is the throatplate of an ordinary boiler, about $\frac{1}{16}$ in. from the edge, by a couple of copper rivets. Slide the firebox and tube assembly into the boiler shell, until the firebox tubeplate butts up against the piece of rod, which forms the front section of the foundation ring; put a cramp over the parts, to keep them in position. Set the firebox central with the shell; then temporarily clamp the crown stay flanges to the sides of the firebox shell, with one cramp at each side, whilst a couple



Improvised steady for squaring tube ends

of rivets are put through flange and shell, to keep the inside in position. The cramps can then be removed, and holes drilled for rivets, clean through the firebox plates and the front section of the foundation ring. Four 1/16-in. rivets will do for the smaller boiler, and five 3/32-in. for the larger. Space the rivet-holes equally. Put two rivets in, then remove cramp and finish the job. Now finish riveting the crownstay girders to the sides of the firebox shell. The holes can be countersunk on the outside, and the rivets hammered flush. No pimples are showing on the full-sized engine, as the boiler and firebox are lagged with wood strips, held by bands around the barrel, and "panelled" on the firebox shell. This can, of course, be reproduced on the little engine; but personally I don't think it is worth the time and trouble for a locomotive intended for hard work.

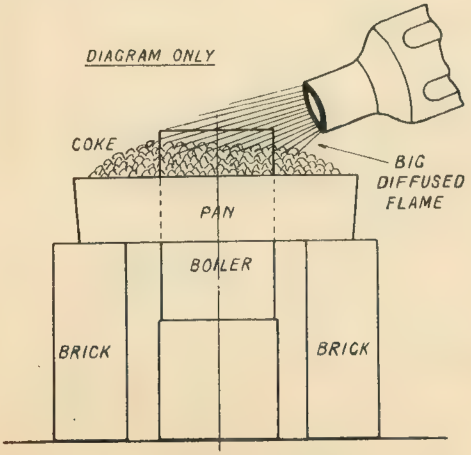
Insert the smokebox tubeplate flange first, tap it down until it almost touches the tubes, line them up with the holes by aid of a wooden meat skewer or a knitting-needle, then finish tapping the tubeplate home until the tubes show through about 1/32 in. The tubes are expanded into the holes by driving in a greased taper drift; I use an old drill-shank. Been going to make a proper roller expander for years, but never got down to it, too much writing and drawing. Anything which has a slight taper, and will fit the ends of the large flues, can be utilised to swell out the ends into close contact with the holes; I've done it, when running against the clock, by putting the business end of a big pair of round-nose pliers in the end of the flue, and twisting the handle, which would give Inspector Meticulous a fit, but was completely effective.

The next job is to braze or silver-solder the assembly. I've already explained umpteen times, how to do the smokebox end, with a lid or tray over the barrel, cutting a hole in same to let the barrel project through, and supporting it on a couple of bricks. Pile some small coke all around, and cover all joints with flux, putting plenty around the tubes. Heat up the coke and the end of the boiler till dull red, then concentrate on any point on the circumference, blow that up to bright red, and apply a strip of easy-running spelter, or a coarse-grade silver-solder. This will melt and start to run; and by working slowly around, the whole of the circumferential joint can be done quite easily. Direct the flame partly outside the shell, and partly inside on the tubeplate. Incidentally, I did this job on the boiler of my *Tugboat Annie*, using my oxy-coal blowpipe, and Johnson-Matthey's B6 alloy, which is really a coarse-grade silver-solder. Once the tubeplate was heated up, and the adjacent bit of barrel, to a sufficient temperature to melt the B6, I directed the flame on the outside of the barrel only, and applied the alloy to the inside. Thus the flame never touched the B6, which was melted by contact with the red-hot copper; the resulting joint was perfect.

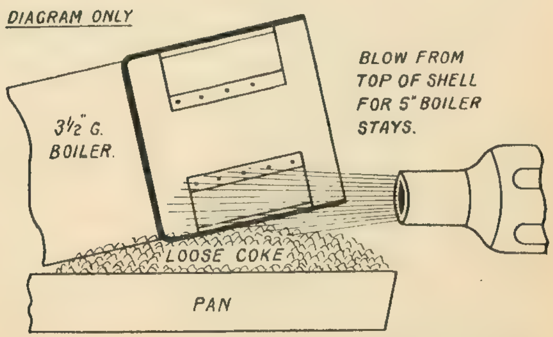
When the circuit is completed, blow the flame direct on the tube ends, and apply some best-grade silver-solder, or Easyflo, to each tube. When a nice fillet has run around each, pull off the tray or lid, lay the boiler on its side in the brazing pan, and do the joints between the crownstay flanges and the shell. Use coarse-grade silver-solder for these. The side of the firebox shell which is being operated on, should rest on some loose bits of coke, so that there is room for the flame to get underneath, and keep the coke glowing. This is another job where a mild even heat will give better results than the fierce concentrated heat of an oxy-acetylene flame. Be sure that all rivet-heads are well covered by the melted silver-solder; then let cool to black, pickle, wash off, and clean up.

How to Fit the Backhead

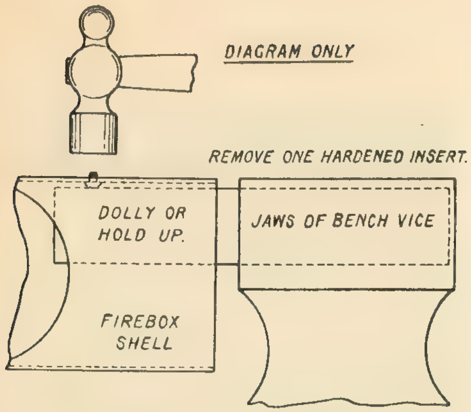
This job is easier than fitting a backhead of the usual type. First, get the position of the hole for the firehole ring, by measuring from the sides and bottom of the firebox shell, to the ring in the doorplate. Transfer measurements to the backhead, and cut the hole; then insert the backhead, flanges first, into the firebox shell, letting the flange of the firehole ring come through the hole. Hammer this outwards and down, gripping the backhead between it and the shoulder of the ring; see longitudinal section of boiler. Make sure that the sides of the shell are tight up against the flanges of the backhead. As the sides of the backhead are straight, and the shell is open at top and bottom, rivets can be put in, to hold the parts while brazing, instead of screws, using 1/16 in. on the 3½-in. boiler, and 3/32-in. on the 5-in. job. Drill clearing holes (No. 51 or No. 41) clean through firebox plate and backhead flange, at about ¾ in. centres, file off any burrs, and put the rivets through from the inside, using a strip of metal about 3/16 in. wide, with a notch in the end like a distant signal. Jam the rivet in the notch, insert in holes, and pull away the bit of strip. For a riveting dolly, or



Safe way to fix smokebox tubeplate and tubes



How to silver-solder crownstay girders to firebox shell



How to rivet backhead in place

"holder-up," put a bit of bar in the bench vice, about 1 in. × $\frac{3}{16}$ in. section, leaving enough projecting from the sides of the vice jaws, to reach to the firehole ring. After the rivet is inserted, put your finger against it, to prevent it dropping out, slip the firebox over the dolly, and hammer down the rivet shank tightly. There is no need to bother, about countersinking, or making fancy heads, as the lot can be filed flush after the final braze-up.

The remaining three sections of the foundation ring can then be fitted, and a few rivets put through the lot, to hold them in place between the firebox and shell. Be sure they are well cleaned, slightly bevelled, and fitted about $\frac{1}{16}$ in. from the edge of the shell. The bush for the washout plug can then be fitted, as shown in the drawings, and the bushes for fittings inserted into the holes in the backhead of both 5-in. and 3½-in. gauge boilers. The backhead joints, and the foundation ring, can then be brazed or silver-soldered. An oxy-acetylene blowpipe can be used on this job, if it is done with Sifbronze, or any similar bronze-welding material. If a blowlamp or blowpipe is used, then make the joints with silver-solder (coarse grade) or B6. The job is done in exactly the same way as on the ordinary type of boiler; stand it upside down in the brazing pan, pile coke all around it, up to the level of the ring, and put some asbestos cubes, or asbestos millboard, inside the firebox to protect the tubes. Flux all the joints well.

First, heat the whole of the ring and the bottom of the firebox, until they start to glow red, then concentrate on one corner, and keep the heat on it until bright red. Apply the silver-solder or B6, which will immediately melt and sweat in; and as this material flows very freely, it will be found that the flame can be advanced a little quicker along the joint, than is possible with ordinary brazing strip. The liquid metal should fill up the grooves, and form a fillet at each side of the ring. Don't forget to go around the bush for the washout plug. When the whole circuit has been completed, up-end the boiler quickly, backhead upwards, and do the flange joint at each side of it. Finally go around the flange of the firehole ring, and all the bushes. It will be found that silver-solder or B6 will sweat clean through all the joints, and seal all the rivets.

If using an oxy-acetylene blowpipe anoint the joints with the special Sifbronze flux, if that material is going to be used. For spelter brazing, or brass wire, use Boron compo. Proceed as above, first heating all the ring, then concentrating on one corner; a very bright red will be needed to start the harder metal flowing, but once it has started, the job will be easy enough. I have already given full instructions on Sifbronzing joints by the "drop-by-drop" method, which is recommended by the makers. Granulated spelter can be mixed with the flux, and spread along the joint with it. Brass wire or brazing strip, is applied like silver-solder, but naturally much more heat is needed to make it flow, and inexperienced coppersmiths would have to watch their step, to avoid burning the copper. Silver-solder should be used for the bushes, as a separate operation, using a soft diffused flame.

When the job is through, carefully examine for missed places, and if all is O.K. let cool to black, and pickle as usual. Be mighty careful with the boiler for the 5-in. gauge engine, as this will now be heavy to handle; and splashes on clothes and anatomy, are things to be avoided at any cost. Fish out and wash off after about 20 minutes in the pickle; clean up, and the boiler will then be ready for the haystack top.

For the BOOKSHELF

Locomotives of the North Eastern Railway, by O. S. Nock. (London: Ian Allan Ltd.). 200 pages, 5½ in. by 8½ in. Four coloured plates. Numerous illustrations. Price 25s. net.

To admirers of the old North Eastern Railway locomotives of the pre-grouping era, this book will be irresistible; to lovers of the locomotive generally, it will appeal on account of, first, the great variety of the earlier engines and, secondly, because it is a concise, but comprehensive record of steady development from the earliest to the latest years. There are many logs and descriptions of runs by several different classes of engines; but what is of especial interest to the more technically-minded reader, there are several extracts from a number of dynamometer records that have never been made public before.

Written in Mr. Nock's best style, the text is easy to read and enjoy, while the illustrations enhance the interest and usefulness of the book. Of interest to THE MODEL ENGINEER readers, at the present moment, is the coloured plate of the 0-8-0 freight engine No. 2122 of Class "T," which is the prototype of *Netta*, by "L.B.S.C." This plate appears twice, once on the dust-cover and once in the book; the former is perfect, in that it depicts all the glory of the original style of painting, but the latter is less satisfactory in that it is far too much toned down. One could scarcely believe that the two plates had been produced by the same printers. The other three coloured plates are reproductions of postcards issued by the Locomotive Publishing Co. in the days when the North Eastern was a separate railway.

There are some typographical errors in the text, but they can easily be corrected in future editions, of which we venture to prophesy there will be more than one.

READERS' LETTERS

● Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

WEIR FEED PUMP

DEAR SIR,—As a regular reader of THE MODEL ENGINEER and one who is keenly interested in steam locomotives, I was particularly pleased with the illustrations of Mr. L. A. Burville's P. V. Baker (issue 31/12/53).

This engine is one of those which "look right," and if the excellent photographs are any indication, appears to be of excellent workmanship. Many of us, I am sure, would welcome a fuller description of Mr. Burville's Weir-type feed-pump. Could he be persuaded to write an article enabling us to construct a similar one ?

The full-size "Weirs" at my place of employment will feed all day at a mere crawl, and I have a copy of the maker's handbook with diagrams, etc.; but details have obviously been considerably simplified in a pump only 3⅝ in. high.

So please, Mr. Burville, give us the "works," and then possibly my own *Juliet* with Baker valve-gear can sport a feed-pump.

Yours faithfully,

Barnsley. R. HAWKE.

OLD ROAD ENGINES

DEAR SIR,—I have been very interested to read the letters which have appeared in past issues of THE MODEL ENGINEER regarding old road locomotives to be seen in various parts of the country. I have myself seen a number of engines in different places, which would, no doubt, be of some interest to steam fans.

Beginning with my own county of Kent, there is an amusement depot in Bullace Lane, Dartford, in which stands a Burrell showman's road locomotive of the "scenic" type complete with car-lifting crane. There is no nameplate visible, but I feel sure that she is *King George V*, an engine I well remember seeing in steam at Blackheath (London) fair before the second world war. The engine stands close to the fence and a good view is obtained from the road.

There is another Burrell showman's engine in Messrs. Botton Bros. depot beside the main Bromley-Sevenoaks road at Green Street Green, Kent. This is also of the "scenic" type, but is not fitted with a car-lifting crane. She bears the name *William the Fifth* and is, alas, in a very dilapidated condition.

At Edenbridge, Kent, about half-a-mile north of the town, beside the road to Westerham, stands a small Fowler tractor and a Sentinel steam wagon of the all-enclosed shaft-driven type. A very nicely turned out Marshall steam-roller may be seen working in the Tunbridge Wells area. She is called *Old Faithful* and is owned by Messrs. G. E. Farrant, public works contractors of North Farm Road, High Brooms. The Tunbridge Wells Corporation also have at least one roller of the Aveling type still working.

At Horsmonden, Kent, there are a number of traction engines in a yard near the railway bridge, including a large Fowler ploughing engine. I believe these may belong to Mr. C. W. Lambert. If so, one of them is probably the Allchin *Royal Chester*, which has been described by Mr. W. J. Hughes in "Traction Engines Worth Modelling."

Just south of the traffic-lights at Godstone, Surrey, is a small piece of waste land on which stands a steam-roller with disc-type rolls, apparently disused. I also saw a Fowler roller with steam up, standing in the county council depot here.

There is a rather impressive group of steam-rollers in a contractor's yard in Sangley Road, Catford, London, S.E. There are about eight or nine engines of various types. Outside the adjacent office hangs a metal plate bearing the representation of a steam-roller cast in relief, this being the only example of a commercial sign depicting a road engine of any sort, that I have so far seen.

In Messrs. Grays amusement depot in the Vale of Health, Hampstead Heath, is a large Burrell "scenic" engine, whilst near the railway station at Blackwater, Hants, in a showman's yard, are two big road locomotives, which look like a Burrell and a Fowler.

Lastly, I have a query: In 1946, at a fair that I visited while it was building up in a field next to Woodford Bridge, Essex, was one of the best examples of a Burrell showman's engine that I have ever seen. She was a "scenic" in spotless condition bearing the name *Evening Star*. On the occasion of my visit she was in steam, with crane in action, erecting the scenic railway. Unfortunately I neglected to note the name of the showman to whom she belonged. Does any reader recall seeing this engine, or, happen to have any information about her ? If, as I sincerely hope, she is still in existence, I would be very interested to know where she is now.

Yours faithfully,

Sevenoaks. D. A. JOHNSON.

TANGYE STEAM ENGINES

DEAR SIR,—I would like to express my great pleasure on seeing the cover of THE MODEL ENGINEER dated 21/1/54 depicting the Tangye single-cylinder engine, also Mr. Edgar T. Westbury's articles on the double Tangye engine, for the following reasons. Some time ago a friend of mine said he would sell me for a pound, a set of horizontal steam engine castings and which he ultimately brought for my approval. The castings were in a cardboard box, which had obviously been in contact with water for some time and were in a deplorable state, but although feeling rather disappointed at the transaction, tried to look cheerful and paid up. A single sheet of drawings, rather worse for wear was also dug up.

Later, upon taking these castings out of the box and making a closer examination, things didn't look as bad as at first sight and I soon got to work with a wire brush, and removed the rust and grime from them. Upon offering the castings together, I was at once struck by the beauty and grace of the little engine.

I hope shortly to start work on the job and Mr. Westbury's articles will be a great help, as one or two operations puzzled me, as I am not a very highly skilled model engineer.

The drawing states that it is a

"Tangye Type Horizontal Engine, 1¼ in. bore and 1½ in. stroke" by the Liverpool Castings & Tool Supply Co., and although it is more of a general arrangement drawing, dimensions are given and as it is full scale, can be worked off very well. The bracket for the governor gear puzzled me, as I couldn't see what position it took on the engine, but your cover photograph makes it clear now.

I very much appreciate Mr. Westbury's articles on Utility Engines and as I have met him at lectures given to the Hull Model Engineers, I know he caters for the man with simple equipment, and is well liked for that accordingly.

Yours faithfully,
Hull. JAMES A. EDSON.

ROTARY COMPRESSORS

DEAR SIR,—I recently carried out a series of tests on a war surplus vane type vacuum pump which will be of interest to your correspondent W. M. R. (Belfast). this pump is a Romec TR/B3 Mk. III, Ref. 127J/251 which is the type available from various sources at prices ranging from 20s. to 45s.

I use it in this manner: a flanged tubular adaptor was made and bolted on to the mounting flange of the pump. After removing the work-table from my Champion No. 3 drilling machine, the pump assembly is offered up through the hole in the drilling machine table bracket and clamped in place with the existing screw. A simply made loosely-fitting extension driving shaft is dropped on the pump shaft and the other end gripped in the chuck of the driller. The whole assembly is then roughly lined up, the table bracket clamped up and the pump is ready to run. I can "plug in" this pump in about the same time it takes to chuck a ½ in. drill.

The pump discharges into a 1-in. cube "manifold," screwed into the body of the pump, which incorporates a ⅜ in. i.d. discharge stub, a pressure gauge fitting, an adjustable pressure relief valve and a gland fitting for a ⅛ in. diameter pipe. This ⅛ in. pipe is used to pressurise a sealed glass lubricator from which oil is metered to the pump bearings via the internal ducts.

At the figures quoted, oil consumption is negligible. This pump drives a brazing torch which I built around a Chance Flamemaster Maxi-flame unit. For the price of this jet unit, 12s. 6d., one can build a first-class torch. This rig operates at a pressure of 15-18 lb. per sq. in.,

Maximum Continuous Loading at 1/3 h.p.			
r.p.m.	lb./sq. in.	cu. ft./min.	Remarks
587	20	2	Cannot be stalled
1,055	15	6	Motor stalls at 18 lb./sq. in.
1,378	10	15	Motor stalls at 12 lb./sq. in.
1,378	4	30	⅜ in. dia. orifice

at 1,055 r.p.m. using a 1/3 h.p. motor on the driller. This gives normal continuous running, I have brazed an *Invicta* boiler at this loading. Blow-by occurs at 30 lb. per sq. in., but it is possible to run at just below this pressure at low r.p.m. for short periods which is useful for test purposes. Higher pressures using ½ h.p. could be obtained, but the operating temperature would then, I submit, be unduly high. A ¼ h.p. motor does not do justice to these blowers.

These converted vacuum pumps and rotary compressors save a lot of trouble and expense in the small workshop. I shall at the first opportunity invest in the R.A.E. model which gives 60 lb. per sq. in., at 2,000 r.p.m. by ¾ h.p. in preference to the orthodox piston compressor and air receiver.

I trust the above will be of interest to your readers.

Yours faithfully,
A. L. N. STEPHENS.
Kingston-on-Thames.

CLOCK LUBRICATION

DEAR SIR,—In the issue of August 30th last, "L.B.S.C." gave readers of THE MODEL ENGINEER a lucid account of his excursion to the realm of clock repairing, an account as interesting as it was lucid.

In it he mentioned that he lubricated the driving spring before replacing it. I have often cleaned and adjusted clocks, good and indifferent—never having been temerarious enough to meddle with a first-class mechanism—and I have yet to see a lubricated driving spring in a clock. I have always remedied the deficiency, as I consider, with "L.B.S.C." that the greasing of the driving springs improves the working of a timekeeper.

Years ago when staying with a friend I noticed that each evening the kitchen clock was brought to him to be wound and set. I was reminded of this when told one morning that my kitchen clock had gone on strike. On examination I found the mainspring was broken about half-an-inch from the inner end. It was possible to soften the broken end, make the necessary hole and bend the end to fit the spindle of the spring. When put together the clock behaved as usual till the same spring was again broken by the same gentle hand. The break was again near the inside end, but this time about an inch was lost. The same operation was performed and the clock worked all right, but its running time was now reduced to some 30 hours. Since then I have wound the clock myself and have now had several years work out of it without any more such breaks.

In my golfing days I used to wear a small wrist-watch when playing. This watch has an excellent movement and was not affected by this treatment until one day, as the result I suppose of a bad stroke, it began to gain several minutes an hour. On taking it to an important firm of watch dealers and doctors, I was gravely informed that it was *magnetised*. This, I thought, to be so much bunkum, but left it for treatment. In due time it was returned to me together with a not inconsiderable bill. Quite a long time afterwards the same illness attacked another wrist-watch, a stop-watch which has a very delicate movement, which I had been wearing when doing a bit of tamping. The same doctor made the same diagnosis, and the bill was quite formidable. A few weeks ago I neglected to remove the stopwatch from my wrist before commencing to do a little hedge clipping, and as a result it again began to beat all records in speeding. This time I had a look at the insides myself and found that two of the turns of the hairspring were adhering to each other. Not trusting myself to use a rigid instrument, I shaved down the end of a toothpick with a razor blade and separated the adhering turns, with the result that the watch resumed normal working.

Yours faithfully,
Argentina. H. G. SHARPE.

Sidelights on DESIGN AND FITTING

By "Duplex"

WITHOUT being unduly critical, it is at times not difficult to find fault with some designs of mechanical appliances and machine elements put forward by workers whose enthusiasm is perhaps greater than their practical experience. However, it is only right and fair that any destructive criticism should always be accompanied by constructive suggestions.

Mechanical design, must of course, be dependent to some extent on reasonable ease of machining, as well as on the kind and size of the materials available for construction; but at the same time, every care should be taken not to violate accepted mechanical principles, and to make full use of information that others in the past have gained by practical experience. More particularly, perhaps, a manufacturer's recommendations as to the application and use of his products should not be lightly disregarded.

Mounting Grinding Wheels

Here, the makers of abrasive wheels stress the importance of adopting the correct method of fitting the inner wheel flange to the spindle of the grinding machine, and they advise that this flange should be either keyed, shrunk or pressed into place to form a rigid abutment face for the grinding wheel. Nevertheless, this recommendation is not always observed, and examples of a loose inner flange, of the kind illustrated in Fig. 1, are occasionally seen. This flange may even be quite a loose fit on the shouldered portion of the spindle, and with this arrangement, the register shoulder for the flange may be less than ⅛ in. in width, yet it has to serve for aligning the wheel under working conditions. Furthermore, according to the manufacturers, the nut retaining the wheel on the spindle should be tightened no more than is necessary to provide an adequate frictional drive, and this will hardly ensure that the inner flange is rigidly held against its narrow abutment face.

However, by following the authoritative recommendations when fitting the flange, there should be no difficulty in making a proper mounting for the wheel. Press the flange, once and for all, on to its spindle and then mount the spindle again between the lathe centres for taking a light facing cut over the abutment face.

The Drill Chuck

The Jacobs pattern drill chuck will hold the shanks of all kinds of drills with great accuracy, and this might be thought to include holding a broken drill by its fluted portion, but it seems unlikely that the three relatively short jaws of the chuck will hold centrally a cylindrical part formed with two spiral flutes. A case in point occurred some years ago, when a friend thought that by using a chuck of this type he could mount drills in a jig he was making for grinding twist drills.

He explained that the drills would be gripped on the two lands, and the tip would project for only a short distance in order to maintain rigidity. To see what would happen, a drill was mounted shank downwards, several times at random, in the drill chuck, and there was no need to check the amount of run-out with the test indicator, for this could be measured better with a rule. In fact, the drill could not be centred at all, and the error would have been worse with a drill of the slow-twist variety, and always present with the ordinary straight-flute drill. The alternative methods of supporting the drill in a V-block or centring it in a collet have stood the test of time. However, drills can be accurately held by their lands if each size of drill is furnished with a cylindrical sleeve to provide a gripping surface for the chuck jaws.

Bearings

It is generally accepted that, whenever possible, the loading on a machine shaft should fall as near to a bearing as can be arranged; which means that bearings should be located to resist to the best advantage the load imposed. Nevertheless, designs are sometimes seen where a belt pulley is fitted to the projecting end of a shaft and the nearest bearing is some distance away.

The shaft then acts as a lever, so that excessive side thrust is exerted on the bearing, causing rapid and irregular wear.

The ideal arrangement is to apply the load directly over the bearing, and the thrust is then entirely radial.

A common example of this arrangement can be found in the

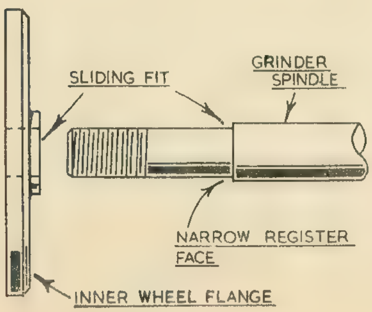


Fig. 1. A loose grinding wheel flange

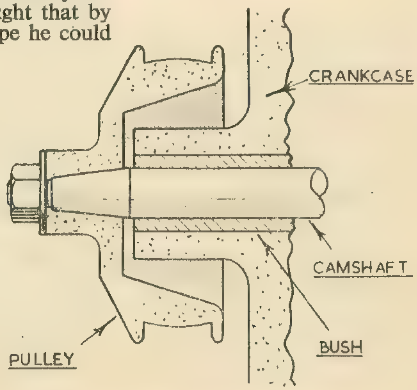


Fig. 2. A typical fan pulley bearing

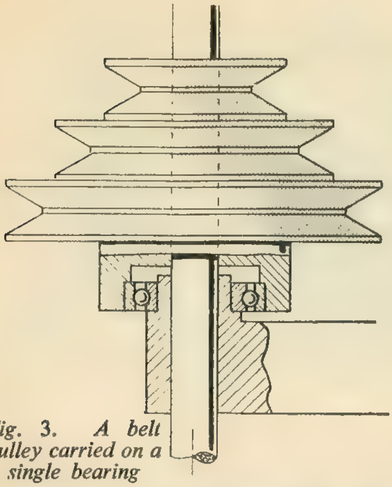


Fig. 3. A belt pulley carried on a single bearing

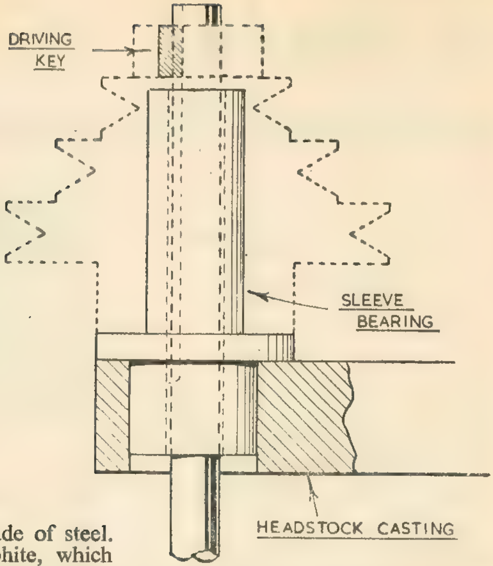


Fig. 4. Mounting the pulley on a long sleeve-bearing

mounting of the pulley driving the fan of a motor-car engine. As shown in Fig. 2, the bearing extends for the full width of the driving belt and there is then no tendency for the pulley to tip on its spindle. In early motor-cycle engines, having plain bearings for the crankshaft, a similar arrangement was used; this made a virtue of necessity, for the pulley had to be placed towards the centre-line of the machine, in order to line up with the belt drum secured to the spokes of the back wheel. A point in connection with bearing design was brought to our notice by a correspondent, who was uncertain as to the best way of fitting a driving pulley to a drilling machine, so that the belt pull was not transmitted to the main spindle. He was considering using a single ball-bearing for mounting the pulley directly on the headstock casting, as represented in Fig. 3. However, the ordinary type of ball-bearing is designed, primarily, to take a radial load and, with the belt running in the upper pulley groove, the belt pull would tend to tip the pulley against the spindle and cause a wedging action on the balls, leading to ultimate damage to the bearing races.

To prevent the tipping action, a second bearing would have to be fitted at the upper end of the pulley. A plain, sleeve-bearing, similar to that illustrated in Fig. 4, is commonly used for mounting the pulley, and this arrangement gives satisfactory service if lubrication is maintained. The bearing should extend for almost the full length of the pulley, and a collar carrying two driving keys is then secured to the upper surface of the pulley.

Where a cast-iron pulley is fitted, the sleeve-bearing is made of steel. Cast-iron contains graphite, which serves as a lubricant and, even if lubrication fails temporarily, scoring of the bearing surfaces is not likely to occur.

Some workers who build their own drilling machines seem to give but little attention to the fitting of the main spindle, although this is, perhaps, the most important part of all, for on its initial and lasting accuracy largely depends the satisfactory working of the machine. A length of stock steel rod is sometimes used for the spindle, leaving the actual bearing surfaces unmachined, but this material is seldom truly round, straight or parallel. Even when the shaft journals are turned in the lathe, some surface roughness will remain and the journals may not be exactly parallel. A highly-magnified machined surface is represented diagrammatically in Fig. 5; here the pointed, surface irregularities will pierce the oil film in the working bearing and, by establishing metal-to-metal contact, will cause abrasion and wear. Moreover, any detached metal particles will add further to the abrasive action.

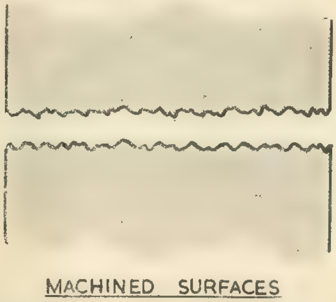


Fig. 5. Magnified appearance of bearing surfaces after machining

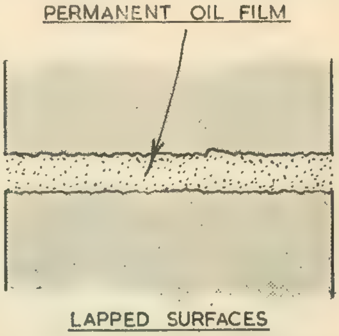
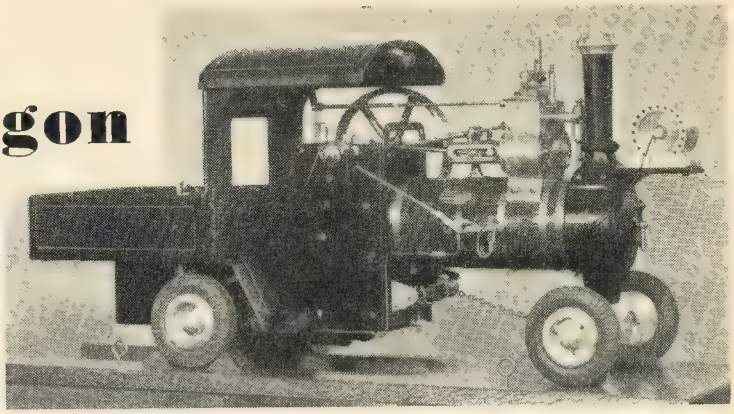


Fig. 6. The same bearing with lapped surfaces

To obtain a close-fitting and wear-resisting bearing, both the spindle and its bushes should be lapped after machining, until all tool marks have been removed and a high surface-finish is obtained. The finished surfaces, when highly magnified, will then appear as shown in Fig. 6. The high spots have been lapped down and the remaining irregularities will not be large enough or sharp enough to break through the oil film. As a result, an unbroken oil film will be maintained indefinitely in the bearing, and metal-to-metal contact and wear will be avoided.

In this way, the small workshop can turn out work as accurately fitted as any produced commercially.

A Model Steam Wagon



By G. Waines (Australia)

HAVING been a reader of THE MODEL ENGINEER for a number of years in the early nineteen hundreds, and now again, I thought the photographs and a brief description of a model Foden steam wagon I have constructed would interest readers.

No doubt they will be subject to criticism by some readers, but I would ask them to remember the model was designed only from memory of what I was indirectly in contact with during the years 1916-19 whilst doing my "little bit" in France.

To begin with—the cycle generator is probably an innovation, but its use in this instance is to illuminate the model, not the road.

The following particulars of construction, etc., may be of interest: boiler barrel $3\frac{1}{8}$ in. diameter brass tube No. 13 gauge; firebox and outer wrapper No. 12 gauge sheet brass; end plates brass castings $\frac{1}{8}$ in. full in thickness. The five tubes are $\frac{7}{16}$ in. diameter No. 18 gauge brass, and the whole job was silver-soldered by a friend with an oxy-torch. The firing is by silent Primus burner. Boiler fittings (most of them purchased from Messrs. Bassett-Lowke) include steam and water gauges, blower, force pump with by-pass, blow-off cock, safety-valve, displacement lubricator and whistle on steamchest. The eccentrics are made with grooved sheave and tongued strap to save space, and link motion reversing gear is now being fitted.

A $\frac{5}{16}$ in. double throw, built up, 90 deg. crankshaft drives through a train of gears to $\frac{1}{2}$-in. pitch cycle chain and twelve (12) tooth sprockets.

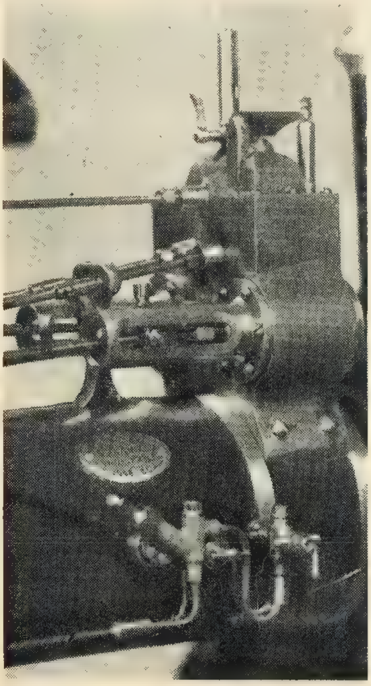
Regarding castings—the flywheel is iron, chimney, smokebox and wheel hubs are aluminium alloy, and the remainder are gunmetal. All were cast at local foundries to my own patterns, the most intricate of which was the $\frac{5}{8}$ in. bore twin-cylinder block with steam jacket passages, and the core box required for same.

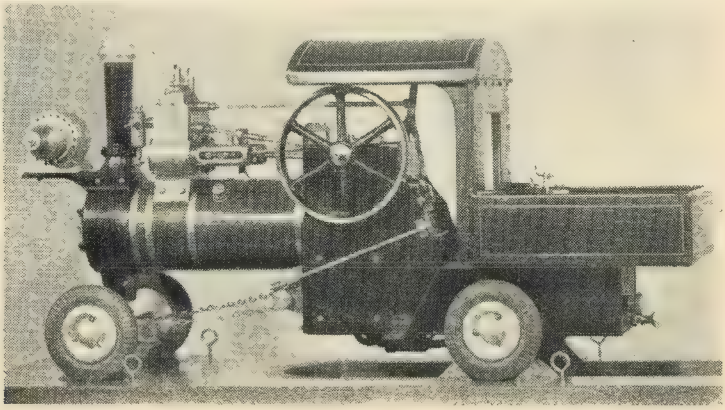
The body-work is done in Nos. 18- and 20-gauge sheet steel, the cabin roof being hinged to give access to the motion.

The model complete weighs 45 lb. and its measurements are—overall length 29 in., height 14 in., wheelbase 17 in. and track $8\frac{1}{2}$ in.

Incidentally, all the machining with the exception of the cast-iron flywheel was done on my 9 in. centre wood-turning lathe (over 100 years old) with hand tools, a 3 in. s.c. chuck, faceplate, and drills from $\frac{1}{16}$ in. to $\frac{5}{8}$ in. diameter, together with sundry files, completing the equipment.

In conclusion, the construction of the model, including making of patterns, etc., took about two years of my spare time.





WITH THE CLUBS

Southend-on-Sea Model Power Boat Club

The annual general meeting was held on Friday, January 1st, when the officers were elected.

Items of interest :—The Southend Corporation have supplied a hut for storage of boats.

The open meeting this year will be held in midsummer instead of September. The 1953 open meeting was a great success with a record entry of boats of all types.

A visitors' night will be held in March at the monthly meeting, where ships will be on show to the public. The radio control section will be specially featured with demonstrations.

Headquarters: St. John's Ambulance Headquarters, Princes Street, Southend.

Hon. Secretary: J. HARRISON, 10, Broadclyst Gardens, Thorpe Bay.

Tonbridge Model Engineering Society

The annual general meeting of the above society was held at the Technical Institute, Tonbridge, on Saturday, January 9th, 1954. In spite of being poorly attended, the usual business of the meeting was completed being followed by the election of new officers for the coming year. This resulted in a past chairman, Mr. H. Mills, being elected to that positoin once more, with Mr. A. Portlock as vice-chairman. Our popular and hard-working secretary, Mr. R. H. Proctor, is continuing in office being assisted by Mr. E. Graville.

The society is anxious to obtain new members and any "live steamers" in the area will be more than welcome. We are the possessors of a fine elevated continuous track, 500 ft. in length, laid for gauges $3\frac{1}{2}'' \times 5''$; this is set in pleasant surroundings near Tonbridge Castle, and during the season good fun is to be enjoyed. A postcard to the undermentioned will bring all the information required.

Hon. Secretary: R. H. PROCTOR, "Roslyn," Coldharbour Lane, Hildenborough, Kent.

Manchester S.M.E.E.

On December 4th our members were honoured by a visit by Mr. W. (Bill) Taylor, of the Urmston Society. The purpose was to give us a lecture on the "how to and how not to," in the making of collets and small injectors, and was supplemented by some very good examples of the work he himself had produced.

The members present were very interested and it proved a very successful subject for discussion afterwards and we look forward to a further visit from him in the not too distant future.

Hon. Secretary: H. H. PENTLAND, 71, Ridgway Street, Moss Side, Manchester, 14.

The Bath & District S.M.E.E.

The society is now well established in its new permanent meeting place at St. James Church Room, Lower Borough Walls, Bath, where meetings are held on the second Friday in each month at 7.45 p.m. Outside visits to places of interest are arranged when possible on the fourth Friday of the month. The next major event is on Thursday, February 25th, at 7.30 p.m., in the Lecture Hall of the Bath Technical College, when Mr. O. S. Nock will speak on "Railways." This talk will be illustrated with special slides.

On Friday, March 12th, a meeting will be held at the club room to discuss the final arrangements for the Bath Hobbies Exhibition. The society is organising a small workshop and a display of member's craftsmanship at this exhibition which will be held on March 31st-April 3rd.

Visitors are welcome at all meetings and the secretary will be pleased to receive any enquiries.

Hon. Secretary: H. WATKINS, 7, City View, Camden Road, Bath.

Ickenham & District S.M.E.

At our first meeting of the New Year, our chairman, Mr. P. R. Fairbairn, described the trials he had recently completed on one of his 5-in. gauge "Speedy" locomotives.

The testing of the boiler of Mr. K. P. Bolley's $3\frac{1}{2}$-in. gauge Atlantic, formed the main event in our programme on January 15th, and at the same time the lubricator pump was tested to a pressure of 250 lb. per square inch.

Our weekly meetings are held every Friday at the Ickenham Memorial Hall where we shall be very pleased to welcome new members.

Hon. Secretary: L. A. GROSS, 16, Thurlestone Road, Ruislip, Middx.

Willesden and West London S.M.E.

The annual general meeting of the society took place on Wednesday, January 27th, 1954, when the following officers were elected Hon. president, Mr. E. J. Oakervee; hon. secretary, Mr. J. Cousins, and hon. treasurer Mr. G. Saggers.

All communications regarding the society should be sent to the new secretary at the following address :—J. COUSINS, 39, Caird Street, Paddington, W.10.

Romford M.E.Club

The annual general meeting, held on Thursday, January 21st, was well attended. The reports of the various officers showed great progress during the past year, and all officers were re-elected for another year.

The "Merit Shield" for the highest aggregate marks for work exhibited throughout the year on competition nights was won by our worthy secretary, Mr. W. S. Rutter, who also won the chairman's prize for the greatest number of exhibits throughout the year. This truly reflects the methodical and painstaking nature of our secretary.

The members expressed appreciation of the services of our enthusiastic chairman, Mr. L. Chilver.

Hon. Secretary: W. S. RUTTER, 154, Glenwood Gardens, Ilford. Tel.: Valentine 1549.

South London M.E.S.

The boat section of the South London Model Engineering Society will be holding their special get together meeting at the White Horse Hotel, Brixton Hill, S.W., on Saturday, February 27th, at 7.30 p.m.

Light refreshments will be provided and Mr. E. T. Westbury will give a talk. All members are asked to make a special effort to attend.

The first club regatta will be held at Brockwell Park, Herne Hill, on May 16th.

The challenge cup presented by Mr. C. J. Hearn, will be presented at the A.G.M., on May 4th, and will be for the best model made by a member since the last A.G.M.

Hon. Secretary: 103, Engleheart Road, Catford, S.E.6.

CORRESPONDENCE

The Managing Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Correspondence and manuscripts should not be addressed to individuals, but to the Managing Editor, THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

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WORKSHOP EQUIPMENT

Buck & Ryan for Lathes and Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661. Open 8.30 a.m.-5.0 p.m. Saturday 1.0 p.m.

"Impetus" machines, wood planers, motorised drills, belt sanders, electric motors, paint sprays, air compressors, circular saws, etc. Catalogue.—JOHN STEEL, Castlefields, Bingley.

New (Slightly Soiled) 2½" 3-jaw (reversible) scroll chucks (model 32/Burnerd) reduced from £5 8s. to £3 10s. (1s. 9d. p. and p.) List supplied on request.—JOHN MORRIS (CLERKENWELL) LTD., 64, Clerkenwell Road, E.C.1.

Rebuilt Lathes. The Acorn Machine Tool Co. (1936) Ltd., offer rebuild to limits "Acorntools" and "Atlas" 10" swing s.s. and s.c. lathes. Hire purchase terms are available. Write—610-614, Chiswick High Road, W.4. (Phone: CHI 3416).

Hobson All-Geared Head Lathes, 3½" × 18" between centres from £53; Eagle surface grinders, 20" table, motorised, 1 h.p., £120 and £140. New vertical milling machines, 18" table from £120; bench milling machines 12" × 4" motorised from £90. H.P. facilities.—VICTA ENGINEERING COMPANY, Maidenhead.

The Acorn Machine Tool Co. (1936) Ltd., are in a position to undertake the complete rebuilding of Atlas, Acorntools, Sphere and Halifax lathes, or, if preferred, we can supply any spare parts that may be required for these machines. Full range of accessories and equipment for all these machines also available. Generous allowance given on old machines against the supply to new "Acorntool" lathes. Secondhand machines, of Atlas and Acorntools manufacture, rebuilt by us available from £75 each. Write to—610-614, Chiswick High Road, W.4. Tel.: Chiswick 3416-7-8-9.

Woodworking Machinery. Send for latest catalogue of "Wilmac" bandsaws and circular saws. These high class machines can be supplied unassembled for home construction at considerable price reduction. Band and circular saw blades for wood or metal.—WILMAC PRODUCTS, Stirling, Scotland.

Orders can again be accepted for ⅜" bench drills. 20 d.p. gears, castings for our 4" lathe, and all our standard lathe components. S.A.E. 3d. stamps for list.—PERFECTO ENGINEERING COMPANY (Machine Tools), 60, Stanley Street, Leicester. Phone: 20078.

Steel Bolts, 6 B.A. × ½" long. Hexagon head, cadmium plated, 2,000 gross offered at 3s. per gross. Nuts to suit at 2s. 6d. per gross. C.W.O. postage paid.—ENGINEERS (RANSONS) SUPPLIES, 130, Friargate, Preston.

H.A.E. 4½" × 28" Screwcutting Lathe, vee bed and stand, £25.—42, Eastway, Morden, Surrey.

For Sale, Complete Workshop, with 8 × 6 shed, wood floor, lathe, tools, locos., radio gear, Viemas chassis. "M.E.s" from 1946, "Wireless Worlds" from 1944, Books, radio, engineering, loco, bench, cupboards, £250 worth. Offer for lot. S.A.E. list. Must sell. Emigrating.—G. L. PENROSE, 145, Malmstone Ave., Merstham, Surrey.

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This Week's Lathe Bargain Offer: Drummond Myford 3½" lathe, nearly new, No. 2 M.T. headstock, all vee drive, self aligning countershaft, angle plate, drill chuck, fluted centre, half centre, set of carriers, set faceplate dogs, set of 12 WIMET TIPPED LATHE TOOLS. Today's value £62. OUR PRICE £47 10s., or £11 10s. deposit and 12 payments of £3. Order now from—CORBETT'S (LATHES & TIPPED TOOLS), Stanton Hill, Sutton-in-Ashfield.

Wanted. Myford "M" type fixed and travelling steadies, also metric taps and dies.—Box No. 7187, MODEL ENGINEER Offices.

Shelby Tool & Engineering Co. Ltd., have made a purchase of a large assortment of new tools for the woodworker, engineer, builder, etc., mostly in original wrappings; bargain prices to clear; send 6d. for lists.—SHELBY TOOL & ENGINEERING CO. LTD., Annesley Woodhouse, Notts.

Drills, H.S.S., 30 mixed 1/32-3/16 (used), 6s. 6d. Taps, B.S.F., Whit., B.A metric l.h. and r.h. threads, mostly new, 24 mixed, 6s. 6d.—MARCHANT, 30, Loretto Gardens, Kenton, Harrow, Middx.

E-W Lathe, B.G.S.C., 4" Burnerd ind. countershaft, pedestal feet, boring table, gear guard, milling cutters, £18, or exchange astronomical telescope.—MR. R. MORGAN, 24, Ty-Coch, Cwmbran, nr. Newport, Mon.

For Sale. 7" Corbett's bench shaper, motorised, new condition, £50, or offer, Also transformer input, 220 V output 0-11 V, for welding, £6.—MR. J. BYWATER, 39, Grace Road, Downend, Bristol.

Sale 4" C.R., B.G., S.C. Lathe, two 3-jaws, one face and catch plate, £30. 4" & 6" × ½" V pulleys, 2" boss, 8s. each.—59, Glenfield Avenue, Deighton, Huddersfield,

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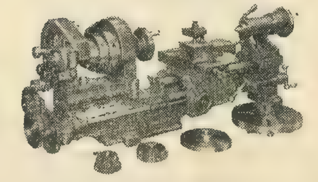

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